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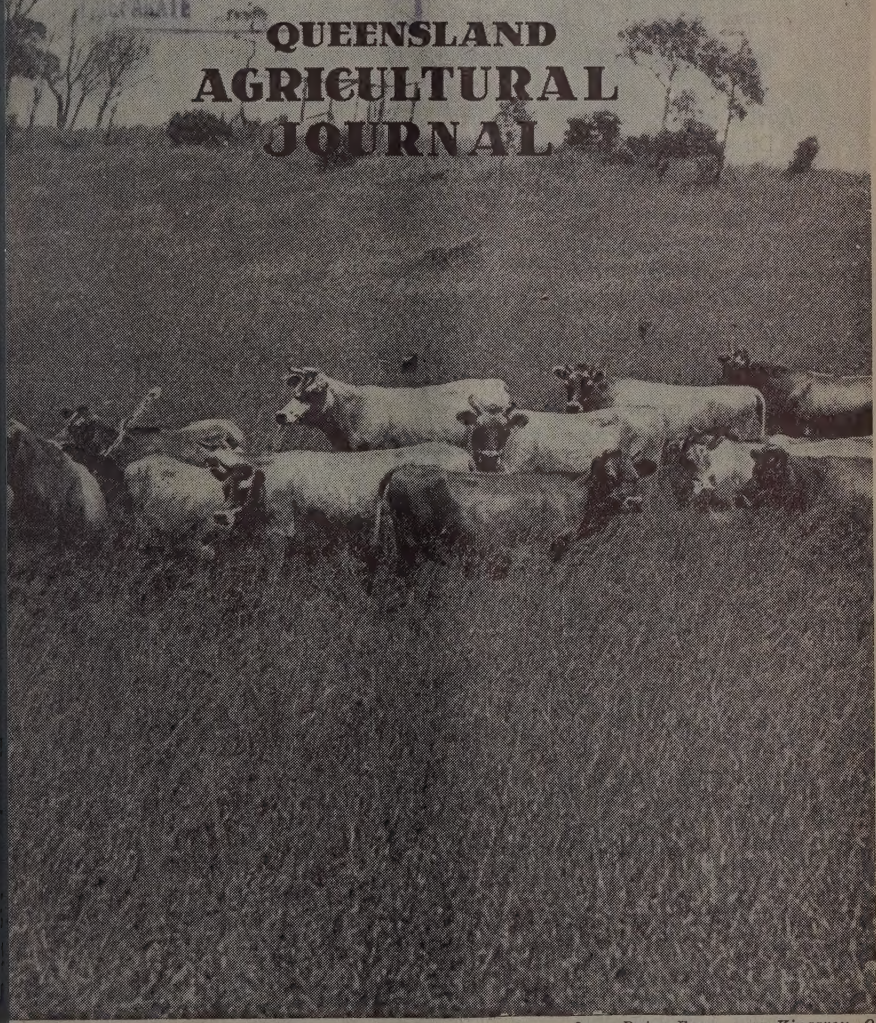
QUEENSLAND AGRICULTURAL JOURNAL



On a Dairy Farm, near Kingaroy, Q.

LEADING FEATURES

Burdekin Potato Crops
Peanut Diseases
Migrations of the Corn Ear Worm
Tetanus, Arthritis, and Fly Strike
A Model Dairy Building
The Feeding of Pigs
Testing of Cattle Dips
Strangles

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Associate Editor
C. W. WINDERS, B.Sc.Agr.

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Contents

	PAGE.
Event and Comment—	
The Year in Agriculture	259
Field Crops—	
Burdekin Potato Crops in 1944 and 1945	261
Plant Protection—	
Peanut Diseases	266
Migrations of the Corn Ear Worm	272
Answers to Correspondents—	
Wild Goosefoot	271
Salsify or Vegetable Oyster	271
Sheep and Wool—	
Tetanus, Arthritis, and Fly Strike in Marked Lambs	275
The Dairy Industry—	
A Model Dairy Building	280
The Pig Farm—	
The Feeding of Pigs	286
Agricultural Chemistry—	
Testing of Cattle Dips	307
Animal Health—	
Strangles	308
General Notes—	
Egg Production—Marketing Problem	313
Quarantine Lifted in Mackay Area	313
Stickfast Flea	313
Rural Topics—	
The Mules Operation Checks Fly Strike	314
Knowledge is Cheaper than Ignorance	314
We All Live on Grass	314
Gadgets and Wrinkles—	
Staking Small Trees	315
Milking Machine—Keep the Airline Clean	315
The Farm Home—	
The Spread and Prevention of Infection	316
Cakes for Smoko	317
Astronomical Data for December, 1945	318
Queensland Weather in October	319
September Rainfall in the Agricultural Districts	320

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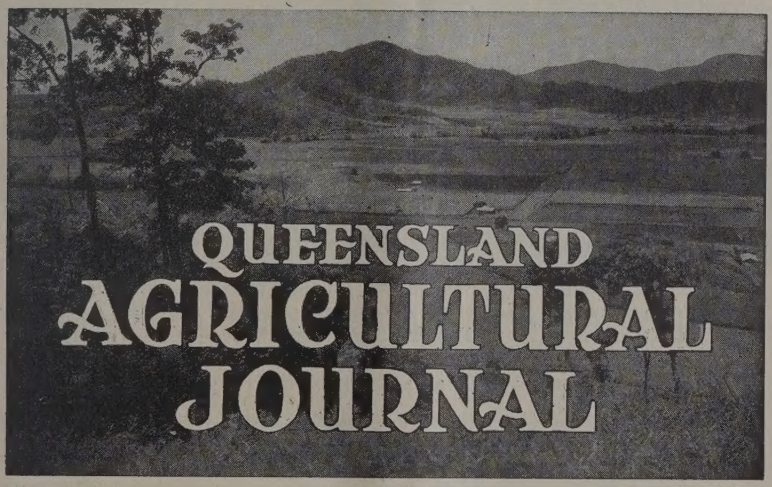


Volume 61 1 NOVEMBER, 1945 Part 5

Event and Comment.

The Year in Agriculture.

IN his annual report to the Minister (Hon. T. L. Williams), the Under Secretary (Mr. R. P. M. Short) presented a comprehensive review of the activities of the Department of Agriculture and Stock for the year ended 30th June last, together with a general appraisal of the agricultural and livestock situation in Queensland.

Climatic and other conditions prevailing during 1944-45 were causes of a marked diversity in crop returns. As an example, the wheat aggregate was 6,500,000 bushels with the highly satisfactory yield of 21 bushels to the acre, while the maize crop on the Atherton Tableland was the lowest on record as a result of excessive rains at critical stages of its development.

Weather conditions were very favourable for both early- and late-sown crops in the chief wheatgrowing areas. Yields of all varieties were above average and one of the new varieties bred by the Department—Pusa X Novo—yielded close to 48 bushels to the acre of excellent milling quality grain. The general quality of the grain harvested was above par, over 90 per cent. being classified as Q1. Eight Queensland-bred varieties occupied 80 per cent. of the aggregate acreage under crop. For maize, seasonal conditions were not generally favourable and a large proportion of the standing crop was cut for cattle feed; from late sowings in some southern farming districts, however, fair to average grain yields were harvested. As with maize, seasonal circumstances were against heavy grain sorghum yields and the best were from late plantings which in some localities returned as much as 75 bushels to the acre.

Last season's sugar production was the highest since 1941, amounting to 640,000 tons net titre, an increase of 157,000 tons over the output of the

previous harvest. There was an increase of 130,000 tons in the quantity exported. The total value of the sugar extracted was £12,740,000.

Potato growers responded commendably to the appeal for greater production. In North Queensland where the pre-war potato crop was never more than a few hundred tons, last season's baggings approximated 8,000 tons out of an aggregate of 34,000 tons for the whole State, a rise of 10 per cent. above the figures for the previous year. Up to 10 tons to the acre were taken off irrigated fields.

Although the season, generally, was unfavourable for high yields, returns from early cotton plantings on new cultivations again evinced the value of cotton in dairy farm rotations in districts suitable for its production. It is becoming increasingly clear, however, that for such rotations there should be provision for late-summer ploughing for cotton so as to conserve all the subsoil moisture possible, and also to ensure penetration of all autumn and winter rains. Where cotton was grown under such conditions last season exceptionally good yields were picked, considering the amount and distribution of the rainfall registered.

Dry weather delayed peanut plantings until December when about 18,500 acres were put under crop. At the end of February, prospects of a heavy harvest were promising, but an ensuing dry spell checked development and so reduced the yield which approximated 10,000 tons. In improving varietal strains of seed, the Department has done notable work in the peanut growing areas and growers are unanimous in their appreciation of this work of which an all-round increase in yield is a result.

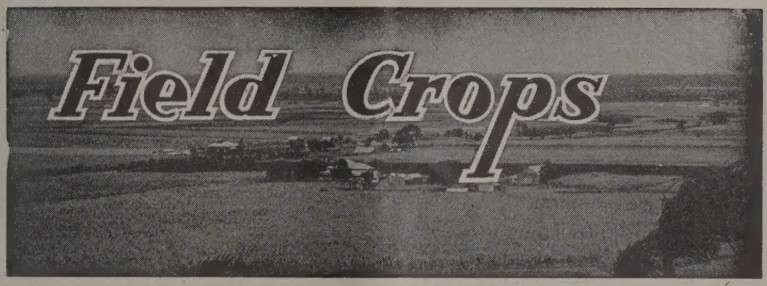
Where seasonal conditions were conducive to satisfactory growth, all other agricultural crops brought good returns. Of crops new to cultivation in Queensland, the canning bean is becoming well established and in some places acreage yields as high as 24 bushels were obtained.

Agricultural experimental work continued on as extensive a scale as was practicable under the prevailing abnormal conditions which affect both the available manpower and the required facilities for carrying on such work. The plant-breeding work in wheat, cotton, and grain sorghum proceeded satisfactorily along the lines laid down in previous years. An extensive programme of varietal, fertilizer, and other field experiments was continued in farming districts as circumstances permitted.

Very real progress was made in horticultural experimental projects, and investigation of a wide range of problems associated with vegetable production was continued. Weed pest problems also claimed close attention. Special attention also was given to soil conservation and management and to improvement in cultural practices.

Although short-staffed through the absence of many technical officers on military duties, the advisory services of the Department were well maintained throughout the year. Included among these services were, of course, the regular series of contributions to *The Queensland Agricultural Journal*. This journal must of necessity be an important link between departmental officers and farmers, because in a State of such vast dimensions as Queensland it is impracticable for field officers to maintain frequent personal contact with more than a relatively small proportion of the farming community.

Generally, the year in agriculture in Queensland was one of satisfactory production and substantial progress.



Burdekin Potato Crops in 1944 and 1945.

R. C. CANNON, Assistant Entomologist.*

APART from sugar-cane, the main field crop in the Burdekin district during 1944-45 was English potatoes. The increasing importance of this crop during the war years led to the initiation of investigational work aimed at determining the most suitable varieties and the best cultural practices for the district. As information from the experimental work becomes available it will be passed on to growers; in the meantime, an outline of the conditions under which the last two crops have been produced and harvested may be of interest.

The 1944 Crop.

Of the total district planting of about 1,250 acres, about 94 per cent. was grown in the Ayr and Home Hill areas and the balance at Giru and Woodstock. The principal variety planted was Brownell, which has been regarded for many years as the best variety for the Lower Burdekin. The 1944 acreage was considerably higher than the plantings for any previous season.

Weather conditions during the growing period were very satisfactory and crops made good progress. By July the majority were approaching maturity and some of the earliest planted were ready for harvest before the end of the month. By the middle of August harvesting of the main crop had begun, and it continued throughout September and into the early part of October. Due, possibly, to a fear of tuber moth infestation, there was a definite tendency to lift potatoes a little too early. It is considered that, in very many cases, insufficient time was allowed for the tubers to reach full maturity and for the skins to harden before digging commenced.

Following a spell of drizzly weather in June some crops suffered damage from rots. This condition appeared to be accentuated where irrigation water had been applied just prior to the rain. Its incidence was restricted to more or less isolated crops and even then the disease affected only portion of a crop. There does not seem any reason to suppose that total production was seriously reduced by rots. The only other disease prevalent during the season was target spot. This was far more widespread and made its appearance towards the end of July, becoming more general during August and September. In crops

* Formerly an officer of the Agriculture Branch.

affected by target spot defoliation proceeded very rapidly and it was concluded that the disease was in a very large measure responsible for this effect. It is reasonable to conclude that this was reflected in reduced yields.

The potato tuber moth made its appearance in the field towards the end of August. Some tunnelling in the leaves and stems was observed and adults could be seen flying when the foliage was disturbed. By the middle of September some tuber infestation became apparent and increased in importance until the completion of the harvest about the middle of October. Most farmers recognised the value of late hilling in providing a mechanical barrier against tuber infestation and made some attempt to follow out the practice. In many cases the soil condition was such that the added covering was of a cloddy nature and of little value in preventing access to the tubers. In others the technique was defective and depressions without any real cover were left along the centres of the rows. In these respects the heavier soils presented greater difficulties than the more sandy types. Late in the season tuber infestation was quite appreciable. However, where farmers were fortunate enough, or careful enough, to provide a loose cover several inches thick and free from cracks, no losses of any consequence were sustained. During digging operations late in the season large numbers of moths were on the wing and were observed laying eggs on the exposed tubers. It is important that bagging should be done with as little delay as possible after digging, in order to prevent egg-laying on the tubers.

In the harvesting of the crop, chain-type diggers were favoured but only a limited number were available, and quite a deal of co-operative effort was undertaken by neighbouring farmers. Other implements used were the mouldboard type potato diggers and a few ordinary mouldboard ploughs. A large part of the bagging was performed by members of the Australian Women's Land Army, who were employed on a piecework basis. These were ably supported by members of the W.A.S.P.S. and by local women and lads not associated with any recognised organisation.

From the 1,168 acres in the Lower Burdekin district a total of about 3,909 tons was exported, the average yield per acre being 3·35 tons of exportable tubers. Yield estimates for the Giru and Woodstock areas are not available.

The 1945 Crop.

The 1944 potato crop proved so successful in all respects that a further expansion of production was contemplated and applications for contracts totalled 2,500 acres. As contracts were available for only about 1,700 acres it was necessary to use some discretion in the allotment of contracts. In order to provide opportunity for the maximum number of growers, and at the same time guard against inefficiency and lack of experience, the following basis was determined for the allotment of contracts:—

(1) No grower was granted more than 25 acres under contract;

(2) 1944 season growers were given an increase of at least 10 per cent. on their 1944 acreage; and

(3) New growers were limited to a maximum of 5 acres each.

The areas of potatoes in the various parts of the district for the 1945 season were as follow:—

—	Brownell.	Bismarck.	Factor.	Others.	Total.
	Acres.	Acres.	Acres.	Acres.	Acres.
Home Hill	696	165	5	4	870
Ayr	497	160	30	21	708
Woodstock	63	48	..	..	111
Giru	14	1	..	..	15
Ingham	..	40	..	..	40
Charters Towers	4	5½	½	..	10
Total	1,274	419½	35½	25	1,754

It was originally provided that only two varieties be grown under contract—namely, Brownell and Bismarck, with only 25 per cent. of the latter. For a number of reasons growers in the Lower Burdekin district were anxious to have their seed supplied by the end of March. It was impossible to obtain sufficient of these varieties from Tasmanian sources in time to meet this requirement. In order to satisfy growers arrangements were made by the Potato Controller to obtain a quantity of Factor seed from New South Wales in lieu of some of the Tasmanian seed. This seed came to hand towards the end of March. Consignments of Bismarck and Brownell came forward during April and the earlier part of May. Practically the whole of this seed arrived in good condition. The quality of both varieties was very good and there was no justifiable cause for complaint or dissatisfaction in respect of the seed of these two varieties. Most of the seed was forward and in good condition for planting within a few weeks after its arrival.

Extensive potato production in this district is a relatively recent development, and rotational practices have not yet been fully developed. Nevertheless, a number of growers grew green manurial crops of cowpeas on land to be used for the 1945 season's potato crop. In most instances, apart from green manuring, careful attention was paid to the preparation of land to be utilised for the potato crop.

Seed disinfection has not been practised in this district. Growers do not yet appreciate the importance of this measure and are, in any case, not well equipped to apply it. Similarly, only a few growers have as yet adopted the practice of shooting and greening their seed prior to planting. The conditions at present existing in respect of seed supplies render such a practice absolutely necessary. The seed is handled several times during transit and the result is that no grower seems able to obtain a distinct line of seed, but obtains an assortment of bags from different growers. Under these circumstances there is not even uniformity in the stage of maturity of the seed used, and stands have consequently been far too irregular. In experimental plots in the district the value of shooting and greening has been amply demonstrated, and it is expected that the practice will gain favour and be more widely adopted in subsequent seasons.

The recognised fertilizer mixture applied to the potato crop is approximately a 10:10:0 mixture and has been applied at the rate of from 500 to 700 pounds per acre, depending on soil type. The majority of farmers have applied the fertilizer with mechanical appliances originally designed for sugar-cane work. In many instances cane

planters have been modified for use in planting potatoes and have proved very satisfactory. The usual practice has been to form a hill about 5 inches high over the furrow in which the seed is placed. After a period of up to a fortnight these hills are partly broken down by the passage of harrows before the young shoots have broken the surface. This has the effect of coping with quite a deal of incipient weed growth and at the same time loosening the surface of the soil to facilitate the emergence of the potato shoots.

Although it is generally believed that success under the local climatic conditions can only be achieved by the planting of whole seed, evidence has been accumulated this season to suggest that the cutting of seed may be satisfactory under certain conditions. In experimental plots and in a few other cases good stands have been obtained from cut seed. It seems imperative that only well shot seed be used for the purpose and that the cutting be performed within a day, or at most two days, of planting. Where this practice has been followed good results have been obtained. On the other hand, the cutting of unshot seed has been followed by disastrous results.

In the Lower Burdekin district the crops made good progress although, as mentioned above, the stands were irregular. The stand irregularities were most pronounced in crops of Factor, largely due to the poor seed used. With the June rain disorders began to appear. Crown rots occurred in many crops in the district but the overall losses are not considered to have been great. Up to the end of June no appreciable development of target spot had taken place; in August the disease became more prevalent and very few crops could be seen without some evidence of it. In those cases where growers had followed some spray schedule with copper fungicides the incidence of the disease was less pronounced. The disease had the effect of reducing the growing period of the crop by a week to a fortnight. It is reasonable to conclude that this would be reflected in decreased yields. It has been noticeable that badly infected crops produced relatively small tubers although there did not appear to be any reduction in the number of tubers formed.

Virus diseases were prevalent throughout. The majority of the Brownell crops were heavily infected with leaf roll and marked irregularities in infection were noted. This is no doubt due to the mixed lots of seed already mentioned. In the Bismarck crops mild mosaic was present. The Factor crops were severely affected with leaf roll. The condition of the Lower Burdekin potato crop in respect of virus infection is, indeed, serious and it is considered that an improvement in the position should be attempted. This question is bound up with seed supplies and, under present circumstances, is quite outside the control of the growers.

Early in August the potato tuber moth made its appearance in the Lower Burdekin crop and as early as the middle of the month obvious tuber infestation was taking place in some of the earlier planted crops. From then on until the end of September moth populations rapidly increased to the point where very few crops were entirely free from some tuber damage. In many instances the losses were as high

as 50 per cent. Neither the time nor the facilities have been available to assess the full extent of these losses but there is every reason to believe that it would have been in excess of 30 per cent. In the Woodstock district the moth did not make its appearance in any numbers until late in September and the losses in this area from this cause have been negligible.

By the end of September the bulk of the crop in the Lower Burdekin had been harvested, and the following approximate figures can be supplied with respect to the 1945 season:—

—	Area.	Total Yield.	Yield per Acre.
	Acres.	Tons.	Tons.
Home Hill	870	4,500	2
Ayr	708		2½
Woodstock	111		4½
	1,689		

Taken by and large the season has not by any means come up to expectations. Disease has been responsible for some reduction in yield but the tuber moth has accounted largely for the reduction in yield below expectations.

Plate 132.

PEANUT AND MAIZE CROPS WITH SUDAN GRASS PASTURE IN THE FOREGROUND, CORNDALE, KINGAROY DISTRICT.

PLANT PROTECTION

Peanut Diseases.

R. B. MORWOOD, Plant Pathologist.

DURING the ten-year period 1934-44, the peanut crop in Queensland showed a remarkable improvement with respect to the incidence of plant diseases. At the beginning of this decade, the Virginia Bunch variety—which supplied practically the whole of the nut-in-shell trade in Australia—was difficult to maintain owing to the increasing severity of crown rot. In addition, all crops showed a considerable loss from both off-type and diseased plants. At the end of the period, serious incidence of crown rot was rare and diseases of the virus type had almost been eliminated. This marked improvement followed on the adoption of routine seed treatment and a seed distribution scheme based on crop inspections and individual plant selections.

Plate 133.

CROWN ROT.—Showing a peanut crop in which the stand has been thinned out by the disease.

SEEDLING BLIGHT AND CROWN ROT.

The disease known as seedling blight and crown rot of peanut appears as a rot which starts in the seed leaves of the plant and then extends from them to the stem. This rotting of the tissues may produce a dry, shredded effect or it may be of a wet slimy nature, according to the absence or presence of secondary organisms. The breakdown of the stem results in the failure of the plant, and this may occur at any stage of plant development from germination to maturity (Plate 133). When the rot sets in early in germinating seed, the plants may not appear above ground and, in the past, stands were frequently reduced to a small fraction of the number of plants which might reasonably have been expected in the field. This disease may also appear on the germination trays when peanuts are being tested, and reasonable germination trials can therefore only be carried out if steps are taken to deal with the disease. Losses due to the presence of this disease after the plants have appeared above ground are generally not as heavy as the pre-emergence losses but they may be responsible for a continuous slow drain on the crop until maturity has been reached.

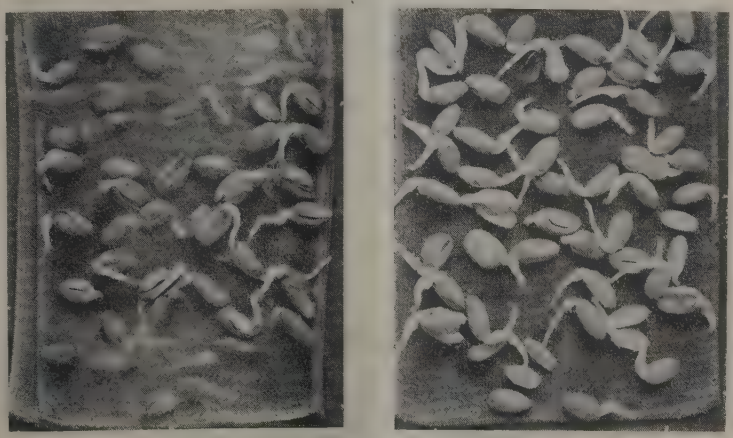


Plate 134.

Effect of Mercurial Dusts on Peanut Germination.—Treated seed on right.

When well-grown plants are attacked by crown rot, they first appear to be affected by a general wilt. On pulling up such plants, the tissues just below ground level are found to be dark, shrunken and shredded, and frequently black masses of spores of the associated fungus can be observed. This fungus* is considered to be a weak parasite which enters the plant through some injury. Even the slight injury which normally accompanies careful machine shelling of the larger seeded varieties of peanut is sufficient to allow the entry of the fungus even though no damage may be apparent. Fortunately, the effect of such abrasions at the time of shelling can be neutralised by the use of a fungicidal dust at a fraction of the cost of alternatives such as hand shelling or the use of whole nuts for seed, the latter-named practice also

* *Aspergillus* sp.

being viewed with disfavour because it possesses certain undesirable agronomic features. The conditions under which the crop is sown have a marked effect on the development of this trouble, e.g., it is much more serious in old cultivations than in land which has been just broken up from grass.

Control.

Excessive injury in shelling should be avoided in order to control this disease and the kernels should be treated with an organic mercury dust as a further protection against infection (Plate 134). Both Ceresan and Agrosan applied at the rate of 1 oz. to 20 lb. of seed have given good results on the Virginia Bunch variety, but on Red Spanish kernels—which actually are less in need of treatment than Virginia Bunch kernels—this quantity of dust may lead to some loss in germination, and the rate of application accordingly should be reduced to 1 oz. to 60 lb. of seed. Both the shelling and the treatment of the seed for planting are carried out in Queensland by the Peanut Board and the principal direct recommended control measure is therefore applied without effort on the part of the grower. The grower, however, is responsible for sowing the kernels and he should see that they are planted on new cultivation or on land which has not grown peanuts for some years. It should hardly be necessary to add that a rotation of crops is a highly desirable practice quite apart from its influence on disease control.

WILT.

Mature peanut crops usually contain a small, but variable, percentage of wilted plants, the wilting of the foliage being due to one or other of a number of causes. For example, it may be a symptom of a definite wilt disease but crown rot, as mentioned above, can cause wilting as also can insect injury to the roots. The wilt disease itself can be identified by pulling up and examining a typically affected plant. The underground portions of such a plant appear sound externally but, on cutting the stem, it will be found to contain a number of brown streaks. These streaks are due to the presence of a fungus* which has entered the roots of the plant and penetrated the water-conducting tissues of both the roots and the stem. Wilt seldom reaches serious proportions and can usually be held in check by adequate attention to the rotation of crops.

LEAF SPOT.

Peanut crops almost invariably are effected by a leaf spot characterised by the presence of somewhat circular, brown spots on the older leaves of affected plants (Plate 135). The spots carry the spores of the causal fungi† but these are so small as to be indistinguishable by the eye. Leaf spot generally affects the crop when it is ripening off, at which stage it is not considered to have any appreciable adverse influence on the productiveness of the plants or on the quality of the nuts. The presence of the fungus may even be advantageous in that it assists in the drying off and subsequent curing of the crop. Adverse effects may occur when the disease appears somewhat earlier than usual, but as yet these have not proved sufficiently serious to warrant the adoption of control measures.

---

* *Fusarium* sp. or *Verticillium* sp.

† *Cercospora personata* and *C. arachidicola*.

Plate 135.
PORTION OF PEANUT PLANT SHOWING LEAF SPOT LESIONS.

Plate 136.
PORTION OF PLANT SHOWING CHLOROSIS IN PEANUTS.

VIRUS DISEASES.

The most serious virus disease of peanut, namely, rosette, has not been recorded in Queensland. Several other diseases, however, which are present in this State are considered, because of their general behaviour, to be virus diseases and are known respectively as chlorosis, bunchy plant, and leaf curl.

Rosette-affected plants either bear tufts of small, curled leaves at the ends of the branches, or the whole plant may be reduced to a tuft of such leaves; a yellow discoloration also develops either uniformly over the leaves or in irregular areas, and thus imparts a mosaic-like pattern to the foliage. In the case of chlorosis (Plate 136), the leaflets

Plate 137.
BUNCHY PLANT IN PEANUTS.

are puckered and yellowing occurs in irregular blotches or mosaic-like areas; there is also a considerable withering of the yellow areas in the later stages of this disease and an affected plant is decidedly dwarfed in stature. The chief symptoms of bunchy plant (Plate 137) are a reduction in the size of the leaves, a shortening of the internodes, and an excessive development of axillary buds. The floral parts of plants affected by this disease are green and proliferated and though there is no mottling, the whole plant may be a somewhat lighter green than is

normal. Plants affected by leaf curl (Plate 138) have their leaflets thickened, brittle, fleshy and curled backward, and elongated light-green streaks appear on the foliage.

Plate 138.
PORTION OF PEANUT PLANT SHOWING LEAF CURL.

Control.

No definite information is available regarding the nature and behaviour of these three diseases. Chlorosis and bunchy plant are widespread in their incidence but they have never affected any large proportion of a crop. Their incidence has considerably lessened during the period in which organised seed selection has been practised. This fact seems to indicate that they are seed borne and that control has been achieved by the careful selection of suitable seed sources.

ANSWERS.

(Selected from the outgoing mail of the Government Botanist.)

Wild Goosefoot.

T.D. (Goondiwindi)—

The specimen is *Chenopodium murale*, Wild Goosefoot, a native of Europe, now widely spread as a weed in most temperate countries. It is quite common in Queensland and is very closely allied to "fat hen." In fact, it is often called by that name. The plant belongs to the Saltbush Family (Chenopodiaceae) and is not known to possess any poisonous or harmful properties. The leaves of some of this family may be used as a substitute for spinach.

Salsify or Vegetable Oyster.

C.L.P. (Nobby)—

The plant specimen you sent is from the Salsify or Vegetable Oyster. This plant is occasionally found as a weed on the Darling Downs. It is not a serious pest so far. The root is used as a vegetable. It is a native of the Mediterranean region. It is known botanically as *Tragopogon porrifolius.*

Migrations of the Corn Ear Worm.

W. J. S. SLOAN, Agronomist.*

MIGRATIONS of the corn ear worm† are well known in the Callide Valley and many acres of cotton are damaged from time to time. Though they may take place during the spring, summer and autumn months, records over very many years suggest that conditions during December and January are most favourable for their occurrence. More than one migration has been noted in a single season as in 1934-35, when cotton crops were damaged by invading swarms of the larvae in early December and again in mid-January, but such behaviour is not usual. Normally the migrating larval swarms consist almost entirely of the corn ear worm but occasionally numerous larvae of the cotton web spinner‡, which often feed on similar host plants, form a considerable part of the population.

Injury.

When the migrating swarms invade cotton fields, crops in the seedling stage may be completely destroyed and replanting is then necessary. Older crops survive and make new growth but the terminal is frequently injured and side shoots develop from the stem. One of these shoots sometimes dominates the rest and such plants develop a more or less normal structure. More often, however, the plants become multiple stemmed with a number of vegetative branches. Crop maturity is usually delayed and the spreading branches add to the difficulties of cultivation. If the plants are growing rapidly, some of the branches split away from the main stem when the crop load is being carried and any seed cotton coming into contact with the soil is stained. Larval swarms which invade fruiting cotton may feed on the foliage and gouge out holes in the more succulent parts of the stem. Most of the feeding is, however, directed towards the squares, flowers and green bolls which are either shed or hollowed out. Plants near the margin of the field where the larvae first enter the crop suffer most severely.

Sources of Migratory Larvae.

Larval migrations may begin either in or outside the cotton field. In the former case, the mass movement of the insects can only occur in crops where weed control measures have been neglected. Migrations from outside the cotton field occur at any time from the commencement of germination to mid-February when the plants are bearing bolls.

Weed hosts play an important part in initiating the migrations for the larvae develop freely on thistles, ragweed, salt weeds, blue top, hogweed, bullhead, red pigweed and black pigweed. If conditions favour a large scale emergence of the parent moth, numerous eggs are laid on the rapidly growing weeds. In the Callide Valley, it was formerly a common practice to allow cotton fields to revert to natural herbage when they were not required for further cropping. For two or more years, these fields carried an abundance of weed growth on which eggs were laid and on which migratory swarms of the larvae

* Formerly an officer of the Science Branch.

† *Heliothis armigera* Hb.

‡ *Lozostege affinitalis* Led.

developed. Actually migrations have been less frequent in the Callide Valley during recent years than they were when many of the farms were only partially cleared and developed. This change in the pest position may be in part due to a decline in the area under cotton, the more extensive plantings of cereals such as grain sorghum and a marked increase in the cattle population. Thus neglected or abandoned fields carrying a dense stand of weeds are much less common than in the earlier settlement period.

Causes of Migrations.

A number of factors contribute to corn ear worm migrations and these include a shortage of food, attacks by parasites and predators, and disturbances due to farming operations.

Oviposition takes place on weeds and cultivated host plants after rains have stimulated moth emergence and plant growth. Larval populations may then develop on a considerable scale. Should dry weather intervene, the rate of plant growth declines and the insects seem to find the food unpalatable and often insufficient to permit the completion of larval development. Migrations then commence. Even when the plants are still making fresh growth, the pressure of larval competition for food continues to increase, particularly if web spinner larvae are present and clutter up both stems and foliage with webbing and excreta. Migrations are most likely to take place when red pigweed, black pigweed and hogweed form the bulk of the food plants for all are shallow rooted plants which wilt under stress conditions. Sometimes the larvae migrate from lucerne even when the herbage is by no means exhausted. This may be due to a deficiency in the diet, for larval development is seldom normal on host plants which have not reached the flowering stage.

Numerous wasps, bugs, beetles and flies are attracted by dense corn ear worm populations, most of them being parasites or predators. Attacks by parasites, particularly when Tachinid flies are involved, are accompanied by evasive movements of the larvae which raise their bodies and jerk from side to side in an attempt to prevent egg-laying. The irritation caused by such attacks may influence mass movements of the larvae.

Lucerne which is heavily infested with corn ear worm is often cut for hay in order to save the crop and mowing may cause the larvae to migrate from the field. If such fields or infested, weedy paddocks are heavily grazed with cattle, the same thing happens. In both cases, the larvae spill over onto adjacent crops and cause a considerable amount of damage. A similar effect is produced within the cotton field when excessive weed growth is permitted. If dense larval populations develop on weeds which are later destroyed by inter-row cultivation, the insects move on to the adjacent cotton where they feed on all parts of the plant.

At the commencement of migration, the larvae move outwards in all directions from the original breeding grounds; some towards the cotton field and some away from it. However, there is a tendency, once food plants have been found by a section of the swarm, for the remainder to converge on the cultivated area. The migrant swarms have been known to travel through three chains of a tall native pasture before entering a cotton crop. Most of the larvae in the invading swarm

belong to the fourth and older instars but invariably some remain behind in the area from which the movement originated; these are usually the younger stages of the insect.

Control Measures.

Control of larval migrations is best obtained by eliminating the sources from which they come, or, if this is not possible, by planting susceptible crops some distance away from weed-infested fields and crops of lucerne. If such precautionary measures fail, some form of insecticidal control is needed to check the development of swarms which are migrating to or have invaded crops.

To check swarm movements, a Paris green poison bait can be scattered along furrows drawn outside the crops at right angles to the line of advance. The barrier is constructed by first throwing a furrow towards the area which is to be protected and then cutting a return furrow into it so that the steep side with a loose powdery surface faces the migrating larvae. The insects are halted by the steep surface and wander along the furrow where they feed on the poison bait. The furrows must be well drawn, free from breaks in the side and not fouled with trash. After a shower, fresh furrows should be drawn, for rain makes existing barriers ineffective. The bait contains 1 lb. of Paris green, 2 quarts of molasses, 25 lb. of bran and sufficient water, usually 2½ gallons, to make a crumbly, friable mash which runs easily through the fingers. The Paris green and bran are thoroughly mixed and the water, in which the molasses has been previously dissolved, is slowly added as the mixture is being stirred.

Furrow barriers which will effectively check migratory swarms can seldom be constructed on very friable or on clayey soils. In such cases, the bait may be scattered over a 20-foot strip on that side of the crop which is threatened with invasion. Rates of application should be heavy; each acre of ground should receive at least the quantity of bait made from 50 lb. of dry bran.

If the crop has already been invaded, the damage may be checked by spraying the plants with lead arsenate. The spray contains 1 lb. of lead arsenate, 1 gallon of molasses and 6 gallons of water, and the infested area, plus a strip of cotton 20 feet wide around it, should be treated at the rate of 8 to 30 gallons per acre depending on the size of the plants. Usually a single treatment will destroy the invading larvae but a second may be required when populations are very high. Succulent weeds dipped in the spray may be used as a poison barrier if they are arranged in layers 6 inches high along the headland in front of the migrating swarm.

THE BUSH FIRE RISK.

The rank growth which followed on the winter rains has set a fire hazard which may increase before the summer rains. Bush fires can be prevented or kept within bounds if ordinary commonsense precautions are taken. The careless use of fire is a serious thing and a whole countryside can be burnt out through someone's neglect to dampen down live coals before breaking camp. Boiling a billy at the butt of a stump and leaving the fire to smoulder, or beside a dead log and letting a fire get away is a common cause of bush burns. By making fire breaks and raking up dry rubbish and clearing away other inflammable material, the risk of a destructive blaze can be avoided.

Tetanus, Arthritis and Fly Strike in Marked Lambs.

G. R. MOULE, Veterinary Officer, Sheep and Wool Branch.

SURGICAL shock and acute blood poisoning following lamb marking were described in the October *Journal*. This article deals with three other serious conditions which may occur in recently-marked lambs.

TETANUS.

Tetanus is caused by one of the bacteria of the anaerobe family gaining access to the marking wounds. These organisms usually multiply in the blood clots which form as the result of the tissue damage caused by castration, and they do not invade the muscles and organs of the affected animal's body.

Tetanus germs, during their growth and multiplication in infected wounds, form an extremely potent toxin which affects the nervous system, and the symptoms of the disease are related to increased sensitivity of the nerves, which is brought about by this poison.

Under field conditions, deaths from tetanus usually occur one to two weeks after the marking operation, though in some cases sick animals may be observed as early as four days after marking.

Symptoms.

Owing to the pressure of work on the station at marking time, symptoms shown by affected lambs very often escape notice, and the lambs are just found dead. The carcasses of lambs which have recently died of tetanus present a fairly typical appearance in that they are found lying on the side, with the four legs straight out and the head drawn back, as shown in Plate 139.

If sick animals are seen, a detailed examination will reveal the following:—

(1) Symptoms usually commence with a stiffness affecting various parts of the body. The lambs move their limbs with difficulty and are unable to bend their joints.

(2) The animals are unable to turn sharply and tend to circle widely.

Plate 139.
TYPICAL APPEARANCE OF THE CARCASS OF A LAMB WHICH HAS DIED OF TETANUS.

(3) The head is inclined to be drawn back and the animals spread their forelimbs wider apart than is normal.

(4) The breathing is more rapid than usual and the temperature is seldom raised above normal.

Plate 140.
"GRINNING" APPEARANCE OF LAMB SUFFERING FROM TETANUS.

(5) On examination, the marking wounds appear to have healed quite well, and there is no indication that there is any infection at this source.

(6) Lambs with tetanus exhibit an increased sensitivity, as they are inclined to flinch or take fits when they are touched, or when sudden loud noises occur within earshot. These fits are characterised by sudden spasms of the muscles and difficulty in breathing.

(7) Affected lambs are unable to suckle, as there is paralysis of the muscles of the throat, and sometimes "lock jaw" occurs. Usually in such cases the muscles of the face contract and the animal has a typical "grin-like" expression (Plate 140).

(8) Lambs with tetanus usually "go down" quickly and are unable to rise. Should assistance be given to the animal to try to get it on its feet it is found that the limbs are quite stiff and the body rigid. The animal can, in fact, be lifted like a board (see Plate 141, in which an affected animal is shown propped against a tree). Once the sheep go down they quickly bloat and the termination of the disease is usually fatal.

Post-mortem Findings.

Very little of consequence is noticed on post-mortem examination. It is not suggested that graziers should post-mortem lambs which have died from tetanus.

Plate 141.
SHOWING RIGIDITY OF LAMB AFFECTED WITH TETANUS.

Treatment.

Treatment is of little avail; it is preferable to aim at preventive measures.

Prevention.

(1) Use temporary yards for working the sheep at lamb marking time. Much used permanent yards become a "hot bed" of infection and should be avoided wherever possible.

(2) Pay strict attention to cleansing the instruments.

(3) Should losses persist after all reasonable care has been taken, it is possible to protect the lambs by the use of an antiserum. This can be injected at the time of lamb marking without causing any serious delay to the work. This antiserum will protect the lambs for the first two weeks after marking, which is the danger period.

Should mortalities from tetanus be severe in the flock after such operations as shearing, &c., through germs gaining entrance by way of shearing wounds, it may be advisable to vaccinate against the disease, using tetanus toxoid. The toxoid is injected at marking time together with the antiserum and confers an active immunity within about two weeks from the time of the injection, and for the remainder of the sheep's life. The use of the combined antiserum and toxoid thus protects the lamb from the time of the injection until death.

The cost of the tetanus antiserum is 14s. 6d. per 100 lambs and of the tetanus toxoid 22s. 6d. per 250 lambs.

ARTHRITIS.

Arthritis is the name given to conditions in which there is inflammation of the joints. Heavy outbreaks of the disease have occurred in lambs after marking, and in these cases the infection gained entrance through the castration, docking and/or marking wounds.

Either of two types of bacteria can be responsible for this disease and the picture seen on post-mortem examination of affected lambs varies somewhat with the nature of the infection, one type of bacteria causing marked pus formation, and the other practically no pus. Both the germs which can be responsible for arthritis have a strong affinity for the joints, and on gaining entrance to the body through the marking wounds they travel by way of the circulating blood to the joints of the limbs, where they establish themselves and cause severe lameness. Initial symptoms may be seen as early as two or three days after marking, though usually they appear from one to three weeks after the operation. While many lambs are affected, few die. The disease has been known to take from three to four weeks to run its course in the field; a small percentage of chronic cases persists and these lambs remain permanently crippled.

Symptoms.

Arthritis usually appears rather suddenly in a flock of young lambs after marking. The first thing noted by the owner is lameness affecting one or more of the lamb's limbs. It may vary from mild to extreme, and be of a shifting nature, which makes it difficult to decide, in the early stages of the disease, just which limb and which joint is affected.

Later, the joints of the affected limbs become hot and swollen. Most commonly, this is seen in the fetlock, knee and hock joints. As the

condition becomes more chronic, the thickening around the joint becomes hardened, and there may be some permanent impairment of the limb.

Affected animals show a disinclination to move and consequently rapidly lose condition through partial starvation. In some cases, however, there is a general reaction characterised by fever, loss of appetite, diarrhœa and finally death.

Post-mortem Findings.

As the results of post-mortem examination vary somewhat depending upon the type of organism which has infected the wounds, the main features are summarised below:—

Pus-forming Infection.	*Non-Pus-forming Infection.*
1. Extensive fibrous thickening around the joint.	1. Slight thickening around the joint.
2. Greenish yellow pus contained in the joint.	2. No pus; joint oil may be a little cloudy or coagulated.
3. Joint lining thickened and roughened.	3. Joint lining not very changed but impression that the joint has "dried-up."
4. Joint cartilage ulcerated.	4. Bluish points under the cartilage. On boiling, bone is seen to be pitted.
5. Bone honeycombed and new bony outgrowths may occur.	5. No marked enlargement of end of bones. No outgrowths.

Treatment.

No treatment for arthritis has been found satisfactory.

Prevention.

Preventive measures centre around minimising the risk of infection at the time of marking by carefully sterilizing the instruments, and by using temporary yards.

Where losses are extensive and result from the non-pus-forming bacteria, vaccination should be practicable.

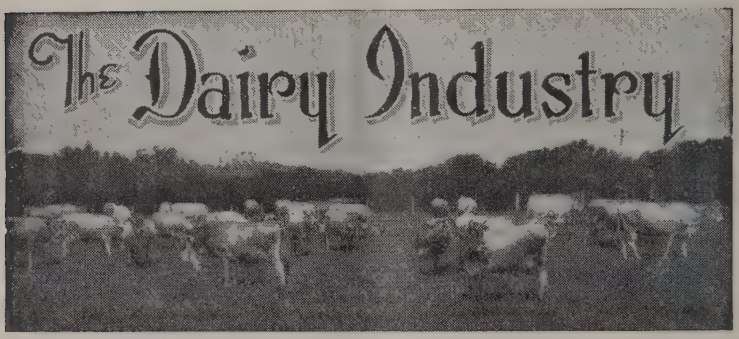
FLY STRIKE.

Blowfly strike of marking wounds is well known to most graziers, and accordingly, little space will be devoted to a description of this condition. The following points are of interest:—

(1) Blowflies are not attracted by a fresh, or rapidly healing wound. It is only after the wound has become contaminated, and is discharging a pus with an odour offensive to man, but attractive to flies, that they strike.

(2) Cutting the lamb's tail at the recommended length, i.e., long enough to cover the tip of the vulva, leads to much quicker healing and to less chance of infection, and thus less likelihood of fly strike.

(3) If it is necessary to mark lambs during a fly wave and a large proportion of them get struck, an easy way of handling the situation is to "breech dip" the lambs in a solution of bluestone and water—½ lb. of bluestone to a gallon of water.



A Model Dairy Building.

C. R. TUMMON, Dairy Officer.

THE accompanying illustrations are of the dairy buildings recently erected on the property of Mr. J. F. Evans, Malanda, North Queensland, and are claimed to be ideal dairy buildings, particularly for the wet climatic conditions prevailing in that dairying district. For drier districts, the same buildings could be used, with some modification in the size of the covered-in holding yard, &c.

These buildings have created much interest and favourable comment among farmers on the Atherton Tableland, and it is generally recognised that they will prove a great incentive for improvement in future dairy buildings to be erected.

The following features of these buildings, some of which may be observed from the illustrations, are considered to be worthy of mention:—

1. Combined type of dairy building. This type is now becoming quite popular in Queensland, and provides more convenience, easier working, and a reduction in expenditure in building over the older type where the dairy house was a detached building. This type also provides for a stock-free area within 30 ft. of the dairy house end of the building.

2. The whole of the main portion of the building, including the milking bails, is ceiled. This, to a large extent, eliminates the possibility of contamination of milk as a result of dust, &c., falling off rafters. It also gives a more finished appearance to the building. The holding-yard is completely roofed. This allows a number of cows to drain in wet weather, prior to milking.

3. All the floor under roof is concrete. This is particularly important in wet areas, and the extra cost is more than justified. A boggy condition in the vicinity of the bails is probably the greatest drawback to comfortable working and an important cause of contamination of dairy produce. The concrete is built up from the floor to a height of 18 in., on which the ground plates for the walls are bolted. This prevents eventual rotting of timber where it meets the

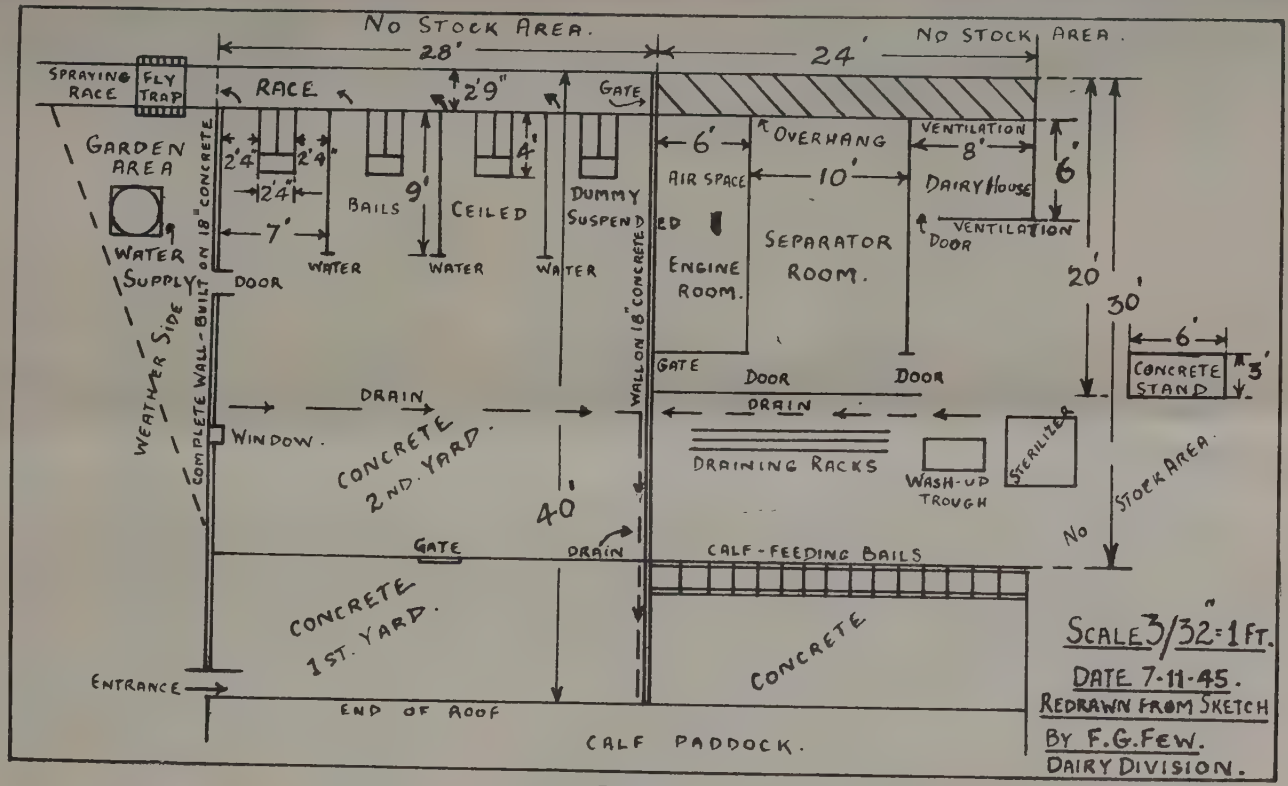


Plate 142.

PLAN OF DAIRY BUILDINGS. PROPERTY OF J. F. EVANS, MERRAGALLEN.

floor and is continually exposed to damp conditions. Instead of the concrete floor and wall meeting at right angles, the angle is rounded over with plaster, to avoid lodgment of manure, &c., in crevices, and providing easier cleaning. The concrete walls are finished off with plaster to provide a smooth surface and are painted similarly to the wood.

4. A wall is provided along the entire length of the weather side of the building.

5. The floor slopes sufficiently to allow good drainage, which is an important feature of such a large dairy building.

Plate 143.

A View of Mr. J. F. Evans's Farm and Stock, Malanda, North Queensland.

6. Dummy bails are securely bolted, and are suspended from above, thus eliminating the necessity for posts to come right to the floor. These posts make cleansing of the floor of bails rather difficult. Feed boxes are provided in the dummy bails. The back half of the feeding box is for storage and the front half is divided into two, allowing the cow at each side of the dummy bail to feed therefrom.

7. An air-space is provided between the bails and separator room, and houses the engine. The air space is properly ventilated and thus prevents contamination of milk or cream in separator room, by smoke, fumes, &c., from the engine.

8. A sterilizer and washing-up trough are installed, thus providing the proper facilities for effective washing and steaming of utensils, milking machine, cans, and other utensils.

9. Calf feeding stalls are provided under the same roof. These are sufficiently far from the dairy house and utensils to avoid doing any harm, and yet are sufficiently close to enable the calves to be fed without having to leave the building.

Plate 144.
THE MILKING SHED, SHOWING EXTENSION ROOF TO PROVIDE A COVERED DRAINING YARD, A DESIRABLE FEATURE IN THE HEAVY RAINFALL AREA OF THE ATHERTON TABLELAND.

Plate 145.
OPEN-AIR WASHING-UP SPACE AND CONCRETE UTENSIL DRAINING PLATFORM.

Plate 146.
SHOWING EXIT RACE FROM BAILS; AND BUFFALO-FLY TRAP (RIGHT).

Plate 147.
CLOSE-UP VIEW OF BUFFALO FLY TRAP.

Plate 148.
ANOTHER SIDE VIEW OF THE MILKING SHED.

10. Note the race (concreted and roofed over) leading from the front of bails. This roof is a protection for wood in front of bails. All bail doors open the same way, to enable cows to pass along the race as soon as milked. This concrete race leads on through a buffalo-fly trap, which may soon be a feature on many dairy farms where buffalo flies occur; and then on further through a race, which may be used for spraying the cattle for ticks. This provides maximum efficiency for treating cattle, with a minimum of handling, and also ensures that boggy conditions are far removed from the dairy buildings. It would be a slight advantage to run cows through a buffalo-fly trap prior to entering the bails. However, this advantage is probably outweighed by the fact that the race from the bails is used as a trap as well.

11. Adequate water supply is available. Taps are provided at each bail, as well as for washing up in the dairy.

12. The buildings are painted throughout. All inside walls and ceilings are painted white, with the exception of the bails, where the paint is chocolate to a height of 3 ft. 6 ins. from the floor and white from there upwards. The building is painted chocolate on the outside. Windows are provided in walls, to allow for light and ventilation.

13. There is some space to spare between the area used for washing up and the calf feeding stalls. This may be used for storing certain feeds, which will in no way contaminate dairy utensils.

14. A large concrete block is provided at the dairy house end, on which to stand the cans of milk or cream, to facilitate loading.

15. The area between the buffalo-fly trap and the gate used as an entrance for cattle to the building may be profitably fenced off and used for a vegetable garden.

The Feeding of Pigs.

F. BOSTOCK, Officer in Charge, Pig Branch.

AS a factor in economical pig production the importance of correct feeding is indicated by the fact that feed represents a very large proportion of the total cost of production. The farmer who expects to make maximum profits shall, therefore, realise the significance of suitable rations and proper methods of feeding.

Pigs are kept on many farms as a means of marketing the surplus grain produced and to utilize dairy by-products. The feeder should have some knowledge of the suitability of the variety of feeds available and, at the same time, realize that complete success cannot be achieved unless thought and care are given to organization, management, layout of the piggery, selection of good quality breeding stock and a high standard of sanitation.

Feeding can influence the quality of the flesh produced and fat development, but breeding also carries weight and good quality breeding stock should always be used. Prime quality pigs are only produced by proper selection of breeding stock, combined with right feeding and good sanitation.

Body Development.

The body development of growing pigs is continually changing, and experimental work has shown that some parts of the body develop quicker than other parts. In the first stage, partly before birth, bone development prodominates; during the second stage, muscular growth takes precedence; followed by the third stage when the greatest tendency is fat development. Early-maturing pigs pass through all stages more rapidly than late-maturing pigs.

Consideration of these factors indicates that to obtain desirable development of the carcase, pigs should be well fed during the stage when muscular growth predominates, that is, up to light porker stage.

Principles of Feeding.

Feeds are usually divided into two classes—concentrated feed, or concentrates; and bulky feeds, commonly called roughage.

The seed of all plants, whole or ground, and all such feeds as are produced from the by-products of commercial establishments, supply

a large amount of nutriment in small bulk, and are called concentrates. The "body" of plants, in the form of hay, straw, green feed, pastures, and root crops, gives bulky feed or roughage.

The function of bulk in a ration is more than the mere provision of nutriment; in a mechanical way it aids digestion, for the stomach has to be comfortably filled to produce contentment. The pig, however, requires less bulky feeds than other domestic animals, but it has been found that bulk or roughage, to some extent, is very valuable in the profitable production of pork. Where roughage is not supplied and the animal is fed exclusively on concentrates, derangement of digestion usually results.

Food Constituents.

From a chemical standpoint, the constituents of feed which immediately concern the pig feeder are the nitrogenous substances, the carbohydrates and fats, and the mineral. The first-named, generally termed proteins, are used chiefly for the development of flesh. The carbohydrates, embracing starches, sugar, &c., together with the fats and oils, are used for making fat for the supply of body heat and energy. Mineral matter or ash is not only valuable as bone-forming, but is necessary for the normal functioning of every organ of the body.

When feed is utilized in the animal body, a certain amount of heat is generated. This heat is converted into energy which is necessary wherever work is performed. The term "work," however, has a very wide meaning and denotes more than actual muscular effort; for, in fact, the performance of nearly every function of the body is actually some form of work, involving the expenditure of energy. It is readily apparent that the heat-producing powers of feed have a much more important function than merely the maintenance of bodily warmth.

Importance of Balancing a Ration.

A ration should, therefore, be properly balanced with proteins, fats, and carbohydrates, and should contain a sufficiency of mineral matter. It also should be suitable as to digestibility and bulk.

To balance a ration or obtain the nutritive ratio, which denotes the number of parts by weight of digestible carbohydrates and fats associated in the food with one part of digestible protein, multiply the percentage of digestible fat by 2·25 (because 1 lb. of fat is approximately as effective as 2·25 lb. of carbohydrates) and add this to the percentage of digestible carbohydrates, then divide by the percentage of digestible protein. When this ratio is more than 1 to 7·00 the ration is said to be wide, and if less than 1 to 4·00 is said to be narrow.

Suitable Nutritive Ratios.

The following nutritive ratios will be found to be suitable for the different classes of stock:—

Weaners	1 to 4.0
Stores	1 to 4·5 to 1 to 5·0
Fattening Pigs	1 to 5·0 to 1 to 5·5
Baconers	1 to 6·0 to 1 to 7·0
Sows in Milk	1 to 5·0
Stud Boars	1 to 5·0

While the nutritive ratio is undoubtedly a good means of determining whether a ration is suitable, it should only be regarded as a rough guide, for it has been found in experiments that pigs increase in weight more in accordance with the total digestible nutriments than with the nutritive ratio.

Total digestible nutriments per day suitable for different classes of stock would be:—

Weaners	1·8 to 2·0 lb.
Stores	2·18 to 2·5 lb.
Fattening Pigs	2·96 to 3·4 lb.
Baconers	3·74 to 4·5 lb.
Sows in Milk	7·2 to 8·4 lb.
Stud Boars	7·2 to 8·4 lb.

The following table shows the digestible nutriments per 100 lb. in various feeding stuffs:—

DIGESTIBLE NUTRIENTS PER 100 LB. OF VARIOUS FEEDING STUFFS.

Feed.	Crude Protein.	Carbo-hydrates.	Fat.	Total.
Barley	8·4	67·5	2·0	80·4
Wheat	9·2	67·5	1·5	80·1
Maize	7·0	65·5	3·5	82·2
Sorghum	8·7	66·2	2·2	79·9
Sweet potatoes	0·9	24·2	0·3	25·8
Pumpkins	1·1	4·5	0·5	6·7
Artichokes	1·0	14·6	0·1	15·8
Sugar-cane	0·4	12·3	0·6	14·1
Green rape	2·6	10·0	0·3	13·3
Green lucerne	3·3	10·4	0·4	14·6
Green maize	0·8	9·9	0·3	11·4
Molasses	1·0	58·5	..	59·5
Separated milk	3·6	5·1	0·2	9·1
Meatmeal	56·2	..	7·2	71·4
Pollard	13·4	46·2	4·3	69·3
Bran	12·5	41·6	3·0	60·9
Linseed meal	31·7	37·9	2·8	75·9
Lucerne hay	10·6	39·0	0·9	51·6
Cotton seed	31·6	25·6	7·8	74·8
Bracken fern root	7·96	54·01	0·54	62·51
Oaten chaff	2·2	34·3	1·2	39·2
Wheaten chaff	1·1	25·7	0·6	28·2

Some Definitions.

Ration is the quantity of food given to one animal for 24 hours, whether given in one or more feeds.

Balanced Ration is the total quantity of food containing the various digestible nutrients in the correct proportions for a given animal for 24 hours.

Maintenance Ration is the quality of food required by an animal for body maintenance in 24 hours.

Digestible Nutrient is that portion of the crude nutrient which can be assimilated by an animal.

Protein is the term used to denote all nitrogenous compounds, used chiefly for growth, flesh development, milk production and reproduction in animals.

Carbohydrates, those materials which include starches and sugars, comprise the greater part of grains, and besides being used for production of heat and energy, are the main source of fat in the carcase.

Fats can influence the type of fat produced in the carcase. Soft fats or fats of low melting point are generally to be found in grains and such crops as peanuts, soy beans and linseed; on the other hand, fats of animal origin, such as fat in meatmeal, are comparatively hard or of high melting point, and do not affect the quality of the carcase.

Fibre: For maximum growth rates and efficient use of feed, pig rations should not contain a high proportion of fibre. Therefore bulky feeds, such as chaff, hay, silage, &c., should not constitute too great a part of the ration.

Minerals are necessary for normal growth and building up of harder tissues of the body, such as bone. Insufficiency of calcium, iron and phosphorus in the ration will lead to serious trouble and setbacks in growth.

Palatability denotes that foods are pleasing to the taste of animals; it is affected not only by the actual composition and condition of the food, but by the custom of the animals which are being fed.

Preparation of Feeds.

Most feeds require little preparation for pigs. Maize may be fed shelled or on the cob; it is not materially improved by grinding. Coarsely grinding or cracking small grains, on the other hand, results in a saving of feed. The extent to which a saving can be made by this operation depends somewhat on the hardness of the grain, but primarily on the method of feeding. Because of the pigs' habit of rapid eating when hand fed in groups, a large number of small hard grains escape being broken by the teeth, and pass through the body unutilized. Pigs accustomed to eating from a self-feeder eat more slowly and masticate their food more completely than do hand-fed pigs.

Soaking is a poor substitute for grinding small grains, and does not improve the value of maize or cracked grains.

Cooking reduces rather than increases the value of most foods for pigs; hotel and slaughter-house refuse, also English potatoes, being the exceptions. A slight benefit may result by feeding a warm swill in very cold weather. Slopping or swill feeding is an old practice, but tests have not justified its use when fattening pigs, and there is very little evidence to show that it is necessary even with brood sows.

Suitable Feeds.

Maize.

Of all cereals, maize is the richest, or one of the richest, in carbohydrates and fat. Maize when fed alone does not supply an efficient ration, especially for growing pigs; and when being hogged down, or

fed either on the cob or shelled, maize should be supplemented with some protein-rich food.

Pigs fatten well on maize, but as it produces a softer bacon than that from pigs fed on most other grains, it should not be fed to excess in the later stages of the preparation of baconers.

Sorghum.

Grain sorghum seed has a fattening value equivalent to 80 to 85 per cent. of that of maize; when fed alone it is an insufficient ration, and should therefore be supplemented with a protein-rich feed. Because of the hardness and size of the grain, grinding may be necessary, especially for young pigs. Outstanding qualities of these grains are their drought-resistance and sureness of cropping. Pigs fatten well on grain sorghums, but unless properly balance with protein supplements are inclined to produce bacon of inferior quality.

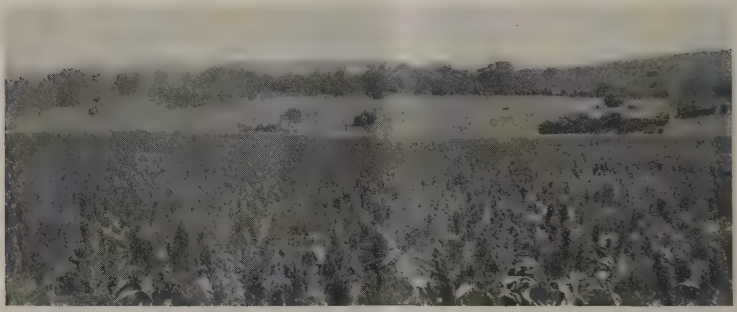


Plate 149.
A Crop of Milo Dwarf Sorghum, an Excellent Grain Crop for Pigs.

Barley.

Of all grains, barley is recognised as the best for fattening pigs. It produces pork and bacon of the first quality, and, particularly, the fat produced is hard, white, and free from greasiness. Barley may be fed alone or with other grains.

Wheat.

Wheat may be fed alone or with other grains. It is an excellent feed for pigs, yielding firm flesh and a satisfactory fat, and possessing a nutritive value equal to barley, while from a protein point of view it is superior to barley. One disadvantage is that if finely ground it is inclined to become doughy when moistened, and for this reason should only be cracked.

Oats.

Oats are not ordinarily used as a pig food because of the large percentage of husk, and when fed to young pigs they sometimes develop scouring. Oats produce a good quality pork or bacon.

Peas.

Peas are rich in protein and are, therefore, useful in balancing such grains as have a high carbohydrate content. Fed alone, they produce a very hard. lean flesh, and young pigs do not thrive on them. Good results are obtained when peas are mixed with other grains, but they should not constitute more than 25 to 30 per cent. of the ration.

Millet.

If fed alone, millet will produce pork or bacon of inferior quality and inclined to be soft. For best results, millet should be mixed with other grains and should never exceed more than 30 to 35 per cent. of the ration.

Beans.

Beans also produce pork or bacon of inferior quality when fed alone, but can be profitably used with other grains, although they should not form more than 15 per cent. of the ration.

Rice.

Rice, if fed in excessive quantity, will produce flesh inclined to be soft. Because of the large percentage of husk, rice should not exceed 25 to 30 per cent. of any ration.

Arrowroot.

Arrowroot is a useful crop, heavy yielding, hardy, and will stand in the field for long periods before it is harvested. Although most of the nutriment is in the bulbs, pigs will eat the tops, which are usually succulent. Arrowroot may be fed raw or boiled, or the pigs may be allowed to harvest the crop themselves. This feed is a carbonaceous roughage and should be fed in combination with more concentrated and protein-rich foods.

Potatoes.

Potatoes consist of about 75 per cent. water and 25 per cent. dry matter, which for the most part is composed of starch. In view of this large quantity of water, 4 lb. of potatoes are generally accepted as being equal to 1 lb. of maize or wheat. This raises the question of bulk, and while potatoes may be fed to all classes of pigs, best results will be obtained when pigs are 16 to 18 weeks old, at which stage the digestive tract will have grown sufficiently to cope with the necessary bulk, and one-third of the grain ration may be replaced by potatoes. As pigs become older the proportion may be increased. Thus, by the time pigs are about 23 weeks old, two-thirds to three-quarters of the ration could be replaced, but it would not be advisable to go beyond this point.

Usually potatoes are too valuable to be used as pig feed, but when they are available they should be boiled.

Sweet Potatoes.

Sweet potatoes are a bulky carbonaceous food which may be used to replace portion of the grain ration; about 4 lb. of sweet potatoes are considered equal to 1 lb. of grain. Pigs of all ages relish sweet potatoes, and they may be dug and fed in the yards, or pigs may be turned on

to the crop and allowed to do the harvesting themselves. The vines make good green feed, but there have been cases of poisoning; this risk, however, is very slight when compared with the large number of pigs which are fed on this crop. When pigs are fed on sweet potatoes, protein-rich foods, such as separated milk or meatmeal, should be included in the ration.

Peanuts.

Peanuts may be fed to pigs of all ages, but because of their very high oil content (about 36 per cent.) will produce soft or oily bacon, and therefore should be eliminated from the ration at least six weeks before the pigs are ready for market.

Soy Beans.

Soy beans also are excellent food for young pigs, but should be used in the same way as peanuts. The high oil content of the soy bean (about 17 per cent.) will produce soft pork or bacon.

Molasses.

Molasses contains approximately 57 per cent. of carbohydrates in the form of sugar, and is therefore a heat and energy producing food. It has a laxative effect on pigs, and is useful in dry seasons when green feed is not available or in short supply. Molasses should be fed in only small quantities, as careless feeding may cause severe diarrhoea.

Sugar-cane and Cow Cane.

These feeds contain large amounts of fibre not digested by pigs, and are of low food value, but during dry periods or when green feed is not available they may serve a useful purpose. Plenty of cane should always be fed, otherwise constipation may result from pigs feeding on the fibre.

Pollard.

Pollard is a valuable addition to grain foods, helping very considerably in balancing the ration, and its fineness makes it very suitable for young pigs. When fed alone, it has a tendency to produce soft flesh, the best results being obtained when used as a supplement to grain foods.

Bran.

Bran, when fed wet, has a laxative action so is useful in preventing constipation in sows. It is usually given just before or after farrowing. It is not recommended as a fattening food.

Meatmeal.

Meatmeal, a protein-rich food, is a meatworks by-product, and is very valuable in balancing grain rations when milk or milk by-products are unavailable.

Blood Meal.

Blood meal is a protein concentrate containing 70–80 per cent. protein. Its palatability varies, but if mixed with other supplements it gives good results.

Fish Meal.

As a protein supplement, fish meal is equal to meatmeal but if fed in excessive quantities may give a fishy flavour to the carcase.

Linseed Meal.

Linseed meal should form only 6 per cent. of a ration. It is a protein-rich food, has a fairly high oil content and a laxative action.

Cottonseed Meal.

Cottonseed meal, a by-product, is a protein supplement. Its use has been limited because some cases of poisoning have been reported when fed in too large a proportion or over lengthy periods. Recent experiments, however, have indicated that up to half the protein supplement of a ration may consist of cottonseed meal.

Cocoa Meal.

Cocoa meal cannot be recommended as a food for pigs, and has been known to cause abortion in sows.

Peanut Meal.

Peanut meal is a source of protein supply which gives good results, but it is preferably mixed with equal parts of meatmeal, the mixture being fed at the same rate as recommended for meatmeal. Peanut meal should not be fed in excess, because bacon produced may be soft and have a distinct flavour.

Skim-milk and Butter-milk.

In supplementary value, skim- and butter-milk excel any other single feed. They are especially recommended for pigs just weaned, as they are very palatable and digestible; they usually contain betwen 3 and 4 per cent. protein, which supplements well the proteins of farm grains. Skim-milk and butter-milk also are rich in essential mineral elements.

While both these feeding stuffs are of equal value for pigs, precautions should be taken to see that the butter-milk has not been diluted with wash water. Both should be pasteurized or boiled in order to prevent the possibility of tuberculosis. Their high value is shown by the fact that roughly 100 lb. can be considered worth half as much as a bushel of maize.

When these by-products are fed in small amounts they have a higher value per pound than when they form a large proportion of the ration. Young pigs require larger proportions of milk to grain than do older pigs. It will be found that about one gallon of skim- or butter-milk per day will balance a maize ration for pigs from weaning age to market weights. During the period of rapid growth (between 90 and 130 lb.), 1½ to 1¾ gallons may be utilized very profitably.

Whey.

Whey has a value of approximately half that of skim-milk or butter-milk.

Relative Value of Feeding Stuffs.

One pound of grain (barley, wheat, maize or sorghum) is approximately equal to—

4 lb. sweet potatoes.
4 lb. English potatoes (boiled).
5 lb. arrowroot.
6-8 lb. pumpkins.
8-9 lb. mangolds or turnips.
5-10 lb. green pasture or forage crops.
10 lb. separated or butter-milk.

Grazing and Suitable Crops.

There is nothing which will solve as many of the problems of pork and bacon production as an abundance of good forage.

Pastures, when green and growing rapidly, are one of the best and cheapest kinds of food for pigs. They provide nutrients needed to balance grain feeds at a lower cost than supplements can be purchased, and pigs make more rapid gains when allowed the run of good pastures. More

Plate 150.
A Paddock of Kikuyu Grass Providing Excellent Grazing for Pigs.

sanitary conditions are to be found where grazing is practised, as well as a reduction in losses from disease. The best foundation for economical production of pork is the maximum use of good quality forage crops and pasture.

One of the advantages of a good mixed grass and clover pasture is the large amount and high quality of the protein supplied. Protein compounds vary as much in quality as a champion boar of to-day differs from the "Captain Cooker" or "Razor-back" of yesterday. All grains

are deficient in some of the essential nitrogen compounds called amino-acids. Pasture crops are rich in the substances needed to make a balanced protein supply, and for this reason pastures are of more value than merely as a means of saving grain.

The vitamin requirement of pigs is becoming better understood and, while there is always a tendency to over-emphasise a new theory, it is realised now that a lack of certain vitamins limits the growth of pigs. Pasture crops are rich in vitamin A. Vitamin D is not abundant in green feeds, but when pigs are grazing they are exposed to the sun's rays, certain of which ensure the requirements of this vitamin. Other vitamins are not so likely to be lacking in rations fed to pigs as A and D, and the more varied rations when pigs are on pasture help to assure an adequate supply.

Minerals are needed by growing pigs; the most common shortages are in calcium and phosphorus. Grains are low in calcium but, where milk by-products are fed, this shortage is supplied to some extent. Legumes in pastures and rape are rich in calcium. While pastures are very valuable feeds, pigs cannot grow profitably on pasture only. There is too much water in proportion to dry matter in young grass, and in the more mature stages grasses have too much fibre.

Summary.

Grazing admits an animal to the healthy influence of sunlight and of securing exercise.

Grazing stimulates the digestive processes and largely assists towards maximum gains in weight.

Grazing provides protein and mineral ash, essential elements in pork and bacon production.

Grazing effects a saving in contrast with sty feeding.

Grazing saves labour.

Plate 151.

PIGS GRAZING ON LUCERNE. CAREFUL MANAGEMENT OF THIS VALUABLE CROP IS IMPORTANT.

Suitable Crops.

When soil and climatic conditions are suitable, lucerne is easily the best green crop for pigs. Careful management of this very valuable crop is important, and it is suggested that pigs be allowed to graze on only portion of the lucerne paddock, and not remain long enough to do damage before being removed to a fresh section. Under some conditions, it may be found more economical to cut and feed the lucerne than to graze it.

The following table shows a number of crops recommended as being suitable for pigs. Further information is contained in a leaflet entitled "Crop Planting Tables," which may be obtained on application to the Department of Agriculture and Stock, Brisbane.

Suitable Crops to Grow for Pigs.

Name of Crop.	When to Sow.	When Available.
Lucerne	April to May	
Barley	March to June	May to September
Rye	March to June	June to September
Oats	April to June	July to September
Rape	March to May	June to August
Cowpea	September to January	January to May
Pumpkins	August to January	January to June
Maize	August to January	December to May
Millet	September to January	November to March
Sorghum	August to February	December to June
Arrowroot	August to October	April to June
Artichokes	August to October	December to February
Sweet potatoes	August to January	November to April
Mangolds	February to April	August to October

Minerals.

Pigs orignally obtained their nutriment from natural pastures. Every necessary chemical requirement to produce perfect results was supplied; thus intestinal disorders were almost unknown to animals grazing at will on virgin pastures. To-day, we have these same pigs with much the same constitutions requiring the same balanced nourishment they required in their wild state. We confine them to limited areas, fed them on dry grains and other foodstuffs, and consequently some ingredients found in nature's pastures are lacking and should be supplied by other means.

Of all farm animals, pigs grow the most rapidly; also, no other domestic animal shows so quickly the result of mineral deficiency. The rapid development up to 180 or 200 lb. live weight at 6 or 7 months of age calls for much bone-building material in the food; also sows produce two litters a year, making their demand for minerals very heavy.

Dairy by-products supply considerable minerals, but even when these are being fed it is well to provide some additional minerals, and

one of the following simple mixtures will be found to meet the general requirements:—

No. 1—Equal parts by weight of—
Air slaked lime.
Sterilised bone meal.
Salt (fine).

No. 2—Equal parts by weight of—
Wood ashes.
Sterilised bone meal.
Salt (fine).

No. 3—To No. 1 and No. 2 mixture add ⅛ by weight of meatmeal to increase palatability.

No. 4—Mix—25 lb. ground limestone.
25 lb. sterilized bone meal.
30 lb. fine salt.
15 lb. sulphur.
5 lb. copperas.
1 oz. potassium iodide.

One of these mixtures should be placed in a small trough protected from the weather to which pigs have access at all times. On the other hand, when dry feeding is practised, 1½ per cent. of ground limestone and 1 per cent. of fine salt may be mixed with the ration.

Garbage.

The quality of garbage or kitchen refuse varies greatly, and it is very difficult to make any recommendations for supplementary feeds. If garbage consists mostly of bread scraps, some protein concentrate should be added; on the other hand, if large quantities of meat scraps are present, grain or pollard may be included to obtain greater food value of the garbage.

Care should be taken to see that no foreign matter such as cloth, paper, glass, nails, &c., is included. There is always a certain amount of risk in garbage feeding, as poisonous and injurious substances may be in the garbage tins and cause the death of animals. Persons feeding garbage are required by law to fulfil certain conditions, details of which may be obtained from the local Town or Shire Council. Garbage should be thoroughly boiled before feeding, otherwise there is considerable risk of disease, such as swine fever, which is carried in meat scraps.

Feeding the Boar.

Generally, boars intended for breeding will maintain their condition on 2 lb. to 4 lb. of grain mixture per day. However, some may be maintained largely on green feed or root crops, with a grain ration of only 1 lb. per day, while others may require up to 5 or 6 lb. daily.

For maximum fertility, it is important that the ration should contain plenty of green feed. It is equally important that a boar should not be overworked, especially a young animal, say nine months old, and while he is still growing rapidly. In the case of a mature

animal, a good general rule would be to provide one boar to every 20-25 sows, but for a young boar just commencing stud work he should not be allowed more than one service a fortnight; also, special attention should be given to the feeding of young boars, and the grain ration should be larger than for the average adult animal, and may be increased to 5 or 6 lb. daily.

As a general rule, the boar's condition is the best guide as to efficiency of management and feeding. He should be kept in good breeding condition, and not too fat. Over-condition will make the boar lazy, clumsy and impotent, and should be avoided.

Feeding the Brood Sow.

Strong, healthy pigs are what every farmer wants when the sow farrows, and to expect such pigs careful feeding and handling of the sow before farrowing is necessary.

The brood sow needs food for three important purposes: first, for her own maintenance; second, for growth of her own body; and third, for the nourishment of the unborn litter. Maize, wheat and barley are too concentrated and lack bone-formers. Skim- and buttermilk, meatmeal, pollard and grazing (clover, lucerne, kikuyu grass, &c.) are the logical supplements to grain. When available, root crops (sweet potatoes, arrowroot, &c.) are suitable substances.

Plate 152.

DIRTY YARDS SUCH AS THE ONE ILLUSTRATED ARE A PROLIFIC SOURCE OF DISEASE INFECTION.

In the early stages of gestation the sow may require little more than good grazing or root crops with approximately 1 gallon of separated milk a day, and clean drinking water available at all times. However, when 5 to 6 weeks before the farrowing date, the sow should be separated from the herd and placed in the springer paddock. About 1 to 1½ lb. of grain should then be fed and this may be increased to approximately 2½ lb. a day with 1½ to 2 gallons of separated milk

or ½ to 1 lb. of meatmeal. Consideration, however, should be given to the sow's condition; she should not be permitted to become overfat, as the effect on the litter may be serious. In many cases, such sows have small litters, often overlay a number of pigs, and the milk flow is poor. On the other hand, stronger, healthier litters are usually the result of careful feeding and thought during this period. Above all things, excepting the food supply only, an abundance of exercise is of importance. All classes of pregnant animals do well only when opportunity for ample exercise is allowed. The general tone and vigour of the mother is reflected in the offspring—the better the general health and condition of the dam, the stronger and more vigorous the young.

Free range on good pasture is best, and maize may be scattered on the ground well away from the shelter shed or sleeping quarters. When lucerne is fed, feeding racks are useful, as they are conducive to light exercise. If, however, sows are inclined to lie around, exercise should be forced. Such effort will be repaid by increased health and vigour of the litters.

Warmth, dryness, ventilation and sunlight are essentials of the ideal pig shed and run, and such conditions may be assured with little expense and thought. Good dry bedding in winter is needed, and to be kept dry should be changed regularly. The sheds should be arranged so as to avoid draughts and prevailing winds, and should usually face north or north-east. Attention to these points will be amply rewarded.

The sows should be kept free from lice by the application of oil (6 parts of sump oil to 1 part kerosene) at frequent intervals, and the bowels kept laxative, as costiveness is detrimental to both sow and expectant litter.

The essentials of brood sow management may be summarized as:—

Provide suitable food, but do not overfeed.

See that sows have plenty of exercise.

Provide warm, dry, well ventilated sheds.

Kill all lice.

Avoid constipation by natural feeding, but administer medicine if necessary.

Practise gentleness with the brood sow, remembering that good treatment promotes contentment, with corresponding profits.

Feeding Sow and Litter to Weaning.

About ten days before farrowing, the sow should be placed in the farrowing pen, with access to an exercise yard, in order that she may become accustomed to the new surroundings, and a careful watch kept to see that her bowels are laxative; if costive, 3oz. of castor oil in bran mash (1½ gallons separated milk and 1 lb. bran) should be given. No food should be given for some time after farrowing, but clean drinking water should always be available. After about 12 hours, 3 oz. of castor oil in bran mash may be given. This will put the sow in good condition for the job of rearing the litter until eight weeks old. Careful feeding at this stage is necessary. The ration should be light, consisting of approximately 2 to 2½ lb. cracked grain, and 2 to 2½ gallons of separated milk or 1 to 1¼ lb. of meatmeal. At about six to seven days after

farrowing the ration should be gradually increased, taking approximately one week to bring the quantity up to full brood sow ration of 6 to 7 lb. of cracked grain, and 2 to 2½ gallons separated milk or 1 to 1¼ lb. of meatmeal, given in two feeds. These quantities should be accepted as a guide only, as no hard and fast rule can be laid down, each case being judged according to the sow's appetite and size of litter. In addition, plenty of clean drinking water should be always available. This does not apply only to the sow, because, whatever their class, pigs do not make maximum gains even with the best of food, unless they have drinking water at all times.

Approximate Water Requirements of Pigs.

Live Weight of Pigs.	Approximate Daily Water Requirement.
30 lb.	½ gal
65 lb.	¾ gal.
100 lb.	1 gal.
200 lb.	1¼ gal.

Plate 153.

Untidy, Littered Pig Yards Such as This Should not be Tolerated.

Suckers.

For some weeks after birth, suckers will do best on sow's milk as a sole diet, and it is therefore important that sufficient supply of this natural and best of all foods should be forthcoming. In the third week suckers should be encouraged to eat supplementary foods, which should be provided in a small trough behind a creep away from the

mother. A little cracked grain or cracked grain and pollard, to which is added meatmeal, which will not cause digestive troubles, provides the requirements necessary for rapid growth.

Young pigs require plenty of direct sunlight and exercise, and should be kept in clean yards or allowed the run of good grass paddocks. Scouring and digestive troubles are caused by feeding from dirty troughs, by eating stale food, or as a result of dirty, damp conditions.

Suggested rations to be fed in the creep are:—When the suckers are four weeks of age a little cracked grain may be given; when five weeks old each should be allowed approximately ¼ lb. cracked grain and ⅛ lb. meatmeal per day, after which the cracked grain may be increased ¼ lb. per week per pig and the meatmeal gradually increased to ¼ lb. per day by the time the pigs reach eight weeks of age or weaning time.

Suitable Mixtures for Creep Feeding

No. 1.—Cracked grain (maize, wheat, sorghum) ..	50 lb.
Pollard	35 lb.
Meatmeal	10 lb.
Linseed meal	5 lb.
No. 2—If pollard is not available, cracked grain (maize, wheat, sorghum)	50 lb.
Meatmeal	15 lb.
Linseed meal	5 lb.
No. 3—If pollard and linseed meal are not available, cracked grain (maize, wheat, sorghum) ..	50 lb.
Meatmeal	17 lb.

Weaning.

One of the principal jobs in pig management is weaning suckers from the sows. The system of weaning followed should include the welfare of both the sow and the suckers. If a sow is a heavy milker, the sudden weaning of her pigs will be apt to result in some of the teats being damaged, but proper handling should avoid this risk. For two or three days before weaning, the sow's food should be reduced. This will assist the drying up of the milk flow; then for two or three days after the sow has been taken away she should be turned in with the suckers for one or two hours each day. If this system is adopted, no trouble should be experienced with the sow's udder.

Weaning time is a criticical period in the growth of young pigs. Unless the process is carried out gradually and, as previously mentioned, the young pigs taught to eat solid food while still suckling, growth is always retarded. Also, if weaners are placed in strange surroundings, they worry and run along the fences. Other trials such as castration and sudden changes of food should not be allowed at weaning time. The best time for changes or operations is before weaning, while the suckers still have the benefit of the mother's milk.

Research workers point out that retarded growth at this period has an adverse effect on the quality of the muscular tissue laid down by the pig, and that the incomplete development of the "eye" of meat in the loin is due to a setback at weaning.

Weight of the litter at weaning time is of great importance, and such weights can be taken with very little trouble. A very good use of these litter weights is to compare the production of different sows in a herd. In every herd it is found that certain lines of blood are much more valuable than others. Some pigs grow faster, mature earlier, and are ready for market quicker. Instead of making selections by observation of the growthiness of litters, actual weights will give considerably greater accuracy. Using litter weights, in addition to other reasons for culling, will build up the standard of the herd rapidly.

Plate 154.
Disease Lurks in Unclean Yards.

This system of culling is reasonably accurate, because, in many cases where both the weights of pigs and amounts of feed eaten by each pig are studied, it is found that in 80 out of every 100 pigs those making the heaviest weights for age had made the most economical gains.

Suitable Rations for Young Pigs.

Rations tried and found suitable for pigs from weaning age to porkers or baconers are given in the following table, which shows the quantities to be fed each day. It is not intended that these rations should be strictly adhered to, but they should serve more as a guide to the farmer when determining the most suitable ration to feed under his particular conditions, and the practical interpretation of the table, when maize, skim milk and green feed are available, would be, for 30 lb. live weight pig, 1 lb. of maize and ½ to 1 gallon of separated milk per day, with good grazing or green feed at midday, the maize and milk to be fed half in the morning and half at night.

The quantity of milk should be kept constant from weaning age to pork or bacon weights, but the maize should be increased ¼ lb. per week per pig.

Should separated milk or butter milk not be available, some other protein supplement, such as meatmeal or suitable proprietary products, should be used.

Suggested Daily Ration for Pigs.

Live Weight of Pig.	Grain (Wheat, Maize, Barley, Sorghum Seed).	Separated Milk or Buttermilk.	Meatmeal (when Milk By-products are not available.	Green Feed, if Hand-fed (Lucerne, Barley, Rape, &c.)
Lb.	Lb.	Lb.	Lb.	Lb.
30 ..	1	5	¼	¾ to 1
50 ..	2	7·5	½	¾ to 1
65 ..	2½	7·5	½	¾ to 1
80 ..	3	7·5	½	1 to 1½
100 ..	3½	5	¼	1 to 1½
120 ..	4	5	¼	1 to 1½
135 ..	4½	5	¼	1 to 1½
150 ..	5	5	½	1½ to 2
165 ..	5½	5	¼	1½ to 2
180 ..	6	5	¼	1½ to 2
200 ..	6½	5	¼	1½ to 2

Substitute for Milk.

The chief foods which will be found available in the drier areas of the State are wheat, barley and grain sorghums, but feeding trials have demonstrated that cereal grains alone are uneconomical and should be supplemented. On the coast milk or milk by-products are used, but where dairying is not practised some other protein-rich food should be found as a supplement to grain.

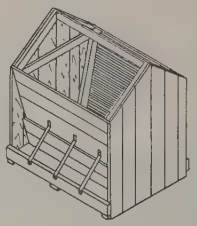
It is generally known that meatmeal is a good substitute for separated milk in the pigs' ration, but it should be used carefully and in correct proportions, otherwise it may prove expensive.

Pigs thrive on small quantities of milk when fed in combination with grain or other foods, and milk supplies the protein necessary to balance the ration. Each pig from weaning age to bacon weight, and dry sows, should receive a minimum of ½ gallon per day, while sows with litters require at least 1½ gallons per day to balance the ration; larger quantities may be used to advantage. However, when these minimum quantities of milk are not available, meatmeal may be substituted, using ¼ lb. of 60 per cent. meatmeal to replace each ½ gallon of separated milk. However, the quantity used should not exceed ¼ to ½ lb. per pig per day from weaning age to bacon weight, with ¼ lb. per day for dry sows, and 1¼ lb. daily for sows and litters.

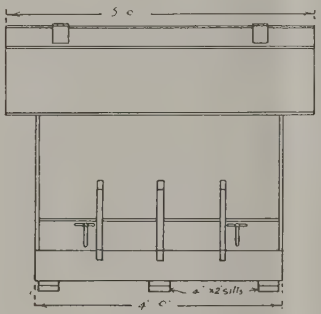
In cases where pigs have access to good grazing or green crops, the quantity of meatmeal may be reduced by up to 50 per cent., depending on the quality of the green food available.

Meatmeal may be mixed with water, fed dry, or mixed in correct proportions with a meal.

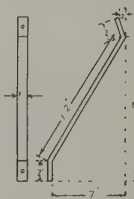
TWO-WAY SELF FEEDER FOR PIGS



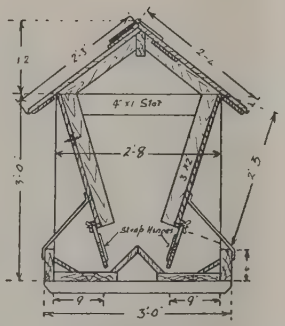
Perspective with Roof Removed



Front Elevation



Detail of Iron Strap



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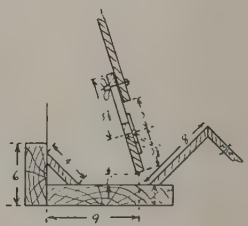


Detail of Slide and Hinged Flap

Drawn by F.B. 1944

Plate 155.
TWO-WAY SELF-FEEDER FOR PIGS.

Suggested Ration for Growing Stock.

Crushed wheat or barley	80 lb.
Meatmeal (60 per cent.)	9 lb.
Good lucerne or oaten chaff	9 lb.
Fine Salt	1 lb.
Ground limestone	1 lb.
	100 lb.

Feeding:

Allow each pig when eight weeks of age 1½ lb. per day, given in two feeds, and increase the meal ¼ lb. per week per pig. Clean drinking water and ample grazing area should always be available.

Self Feeding.

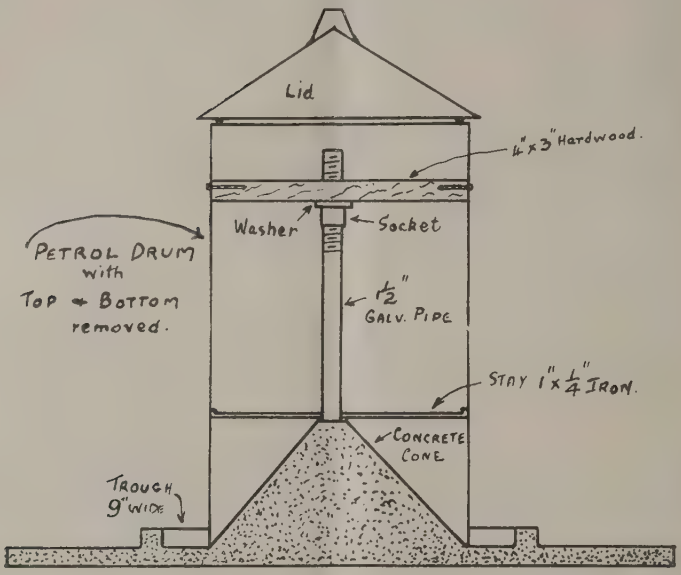
The progressive pig raiser is continually on the lookout for equipment which tends toward making for more efficient management; in this regard there is nothing that can lessen the labour costs and make his lot an easier one to the same extent as the installation of self-feeders.

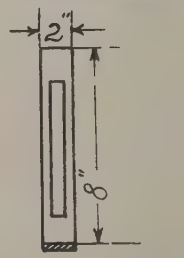
The self-feeder is designed primarily to keep a supply of grain or grain mixture constantly before the pigs and at the same time protect the contents from the weather.

It consists of a bin or hopper, to hold the bulk supply of food, and a feed trough below, which is automatically replenished from the bin as the pigs use up the feed. It is necessary to build the self-feeder large enough to hold enough feed for several days, but it should be remembered, however, that when the self-feeder is filled it is not a matter of simply leaving it until it is empty; a constant watch should be kept on the flow of food into the trough. In wet weather the food is liable to clog, and together with the mud carried in the pigs' snouts and feet, may choke the outlet, and also the feed may become soiled, making it unpalatable to the pigs. These troubles can be alleviated by daily inspections.

A noticeable feature about pigs that are accustomed to self-feeders is that there is no over-crowding, and only a small quantity of food is consumed at any one time; it is eaten slowly, thoroughly masticated, and there is little or no waste; neither is there any risk of overeating or serious digestive trouble. It is always advisable to have good pastures for the pigs during the time they are on the self-feeder, and it is important that a permanent supply of clean drinking water is available.

Farmers feeding dairy by-products will have less need to feed mixtures containing protein meals such as meatmeal &c., as separated milk is very suitable to balance grains such as wheat, maize, and sorghum seed. Dairy by-products should not be self-fed, as they spoil if more is given than the pigs will clean up at one feeding. The practice should be to self-feed the grain, and hand-feed twice daily enough separated milk to balance the ration.





IRON BRACKET
(4 Required)

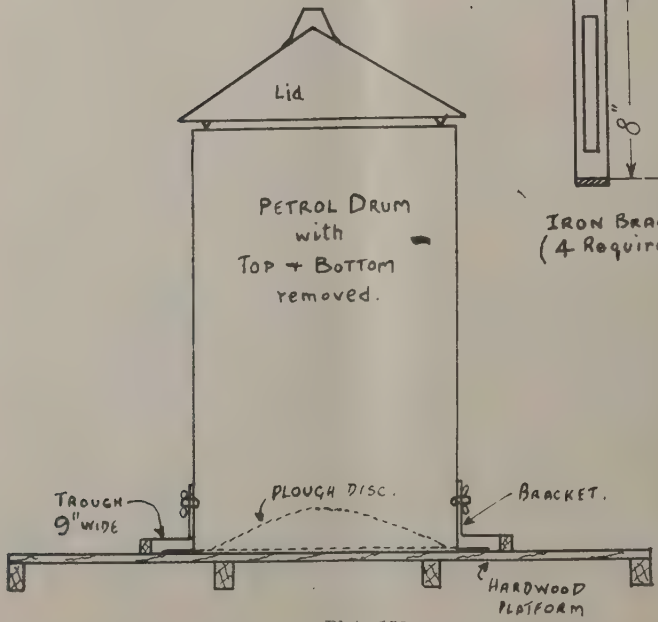


Plate 156.

TWO TYPES OF SELF-FEEDER MADE FROM 44-GALLON PETROL DRUMS.

Agricultural Chemistry

Testing of Cattle Dips.

J. L. FORAN, Acting Chemist.

CONTROL of the cattle tick in Queensland depends upon the regular and systematic dipping of cattle in infested areas in an arsenical solution. The strength of the dip should ke kept at about 8 lb. of arsenic per 400 gallons of water. Weaker strengths are inadequate for the destruction of the tick, while stronger solutions may injure the cattle. Under *The Diseases in Stock Act*, in cases where dipping is compulsory the cattle are put through a dip solution of a standard strength at regular intervals. The Chemical Laboratory of the Department provides a service whereby owners or persons in charge of vats may have the contents of these vats regularly analysed in order to determine what amount of water or arsenic must be added in order to maintain the dipping solution at the required strength.

The Fourth Schedule of the Regulations under *The Diseases in Stock Act* sets out the information which must accompany samples of dip contents submitted for analyses. These include such things as capacity of the vat, working level, concentrate used, and so on. Without full information on these points the Agricultural Chemist cannot make the necessary recommendations for the correction of solutions to standard strength.

Owners of vats and other persons sending samples of dipping solutions are urged in their own interests to supply all the required information with each sample.

Plate 157.

A HORSE TEAM READY FOR THE ROAD ON ROCKWOOD STATION.—The motor truck has almost entirely superseded the horse-drawn table-top wagon on western wool tracks.

ANIMAL HEALTH

Strangles.

A. L. CLAY, Divisional Veterinary Officer.

STRANGLES is the name given to an infectious disease of horses, which is rapid and severe in its effects, usually accompanied by fever, and characterised by inflammation of the lining membranes of nose and throat, together with abscess formation in neighbouring lymph glands. Inflammation of the lining membrane of the throat is known as pharyngitis (sore throat) and will hereinafter be referred to as such.

Occurrence.

The condition is often regarded as being essentially a disease of young animals, but this view needs modification, as animals of all ages may be affected (and severely too) under conditions favourable for the spread of infection. It may occur at any time of the year, but more commonly occurs during "change of season"—viz., autumn and spring.

Cause.

The cause is believed by nearly all authorities to be an organism known as *Streptococcus equi*. A streptococcus, when viewed through a microscope, is in appearance remarkably like a string of beads. *Str. equi* is invariably present in the discharges and is virtually peculiar to the horse, having been found only on very rare occasions in other animals.

Method of Infection.

Usually the disease is the result of a horse partaking of food or water contaminated by discharges from a horse already affected. It may also be the result of breathing air containing contaminated material in a finely divided state, though this is less common, particularly in the case of horses running at grass.

Contact with diseased animals or their discharges is, however, not always necessary before horses can become affected. This is considered due to *Str. equi* being sometimes present in the respiratory passages of "healthy" horses for long periods without causing any ill effects. Should such a "carrier" horse have its natural resistance lowered by influences such as exposure, overwork, or food which is lacking in either quantity or quality, then the *Str. equi* becomes a striking force once again and may start an outbreak of the disease, especially if highly susceptible animals are at hand. The harmfulness or virulence (as it is called) of the organism seems to increase greatly as the result of passage or transfer through and from horse to horse.

Infective material in mangers, nose bags, water troughs, or on grass probably becomes harmless in the course of a few weeks, though there is some doubt on the point, especially as the *Str. equi* is recognised as being a highly resistant organism as judged by laboratory tests. It is to be noted that a single heavy frost cannot be relied upon to render discharges on the ground harmless, though a series of frosts probably would.

Immunity following recovery from an attack of strangles is of some considerable standing, and it is rare for a horse to again become affected within a year. Even then the horse has to be exposed to infection of a virulent type such as is met with in an outbreak characterised by a large number of cases, severe or malignant in type. In such circumstances, horses which have had strangles in former years do contract the disease a second time though not by any means invariably.

Symptoms.

These are many and varied and depend on the type of case. The average period of incubation (time between infection taking place and the first appearance of symptoms) is 3-4 days. Typically the affected horse "goes off his feed" more or less suddenly. If the body temperature is taken at this time it will be found (usually, but not invariably) to be elevated. A watery trickle appears at one or both nostrils, which later changes in character and becomes pus-like. A similar discharge is seen from the eyes. At the same time an ill-defined and firm swelling develops under the jaw towards the throat region; this is the typical strangles abscess. Later the swelling softens and eventually bursts and discharges the contained pus. However, a profuse nasal discharge may be present in the absence of any apparent glandular swelling, or conversely an abscess may form under the jaw without any marked nasal discharge.

Abscess formation may occur in situations other than under the jaw; almost anywhere about the head, along the sides of the neck, shoulder, chest, and even as far back as the abdomen. In such cases the disease is often spoken of as "bastard" strangles. Coughing is a constant symptom and in the later stages is often accompanied by the expulsion of purulent material from the nostrils. The breathing may be little affected in many instances but often is noisy and obviously carried on with some difficulty (hence the name "strangles"), due to swelling of various structures and pressure on vital parts of the respiratory tract. In rare cases the interference to respiration may be so great as to lead to death from suffocation, especially if the affected animal is forced to lead.

Symptoms of pharyngitis are a frequent accompaniment of the disease and are of great importance in making a diagnosis in those cases which do not run a typical course. Swallowing is difficult and painful. Half-chewed food remains in the mouth and may later drop out or be ejected by coughing. When drinking, water can be noticed returning through the nostrils, particularly if the animal is watering from ground level. There is a tendency to "poke the head out in front," and the region of the throat is tender to pressure. The pain occasioned by swallowing may be so great as to cause the affected animal to abstain from feeding for long periods. Loss of condition in such circumstances is rapid and very considerable.

Other symptoms sometimes seen in strangles are nose bleeding, "bunged up" eyes, greatly swollen lips, cheeks, and nostrils, profuse salivation with frothing at the mouth, teeth grinding, and itchiness of the skin evidenced by rubbing and biting the affected areas.

After Effects.

There is a long period of convalescence and horses should not be put to anything other than very light work for 4-6 weeks; much depends on the severity of the attack, but it must be remembered that too early a return to full work may lead to pneumonia.

A common sequel is chronic inflammation of the head sinuses, with persistent nasal discharge taking a long time to clear up entirely. "Roaring" may sometimes be an after effect of strangles, but it seems likely that special circumstances must obtain for this to occur. In almost all cases there is considerable (occasionally, tremendous) loss of condition. Pneumonia seldom supervenes if the case is well managed.

Prevention.

A first principle is to keep healthy horses well separated from horses affected with the disease. This in itself is not, however, sufficient, as from what has already been said it is obvious that the watering and feeding arrangements must also be absolutely distinct for healthy horses. In practice this is not always easy, but every effort must be directed towards the attainment of that objective, even to the extent of providing separate attendants.

A major difficulty in the prevention of strangles is the management of horses which show a nasal discharge, a cough which is "not a bad cough" and symptoms of a mild pharyngitis, but no sign of a swelling under the jaw or elsewhere. The tendency is to regard such animals as cases of "cold" or of "catarrh" and not of strangles. Whilst this view is often correct it is not always so, and may lead to disastrous results from the standpoint of preventing the spread of the disease, as such animals are sometimes horses which simply display more than ordinary resistance to the disease, but which nevertheless contain the infective agent *Str. equi* in their discharges and which therefore are capable of causing typical strangles in other more susceptible horses. If strangles is known to be present on a property or in a district, then any horse showing a nasal discharge should be regarded as suspect, and isolated until such time as the discharge clears up. If this is done at the outset, much valuable time and labour will be saved.

Overwork and, paradoxically enough, lack of exercise increase susceptibility of horses to strangles. Congregation and confinement of horses in restricted areas favour the transfer of infection. Underfeeding, or the feeding of dusty fodder lacking in vitamin, lowers resistance. The use of common mangers or nose bags and drinking troughs for numbers of different horses is fraught with danger.

The remedies for all of the evils mentioned in the preceding paragraph are obvious enough; easy to put into practice where only small numbers of horses are involved, but difficult (sometimes extremely so) where large numbers of horses are concerned.

The use of strangles vaccine as a preventive measure is accepted by some as a useful measure, although entirely rejected by other authorities. There is little doubt that different outbreaks of the disease vary greatly

as regards the virulence of the infective agent. In those in which the virulence of *Str. equi* is comparatively low then the vaccine may afford adequate protection, but in those in which the virulence is high and there are many cases of a severe or malignant type, then the protection afforded is likely to be quite inadequate. Recent research work on the *Str. equi* gives grounds for hoping that a new and much more effective vaccine will ultimately become available; in the meantime the use of the vaccine at present available is to be recommended, as even though it cannot be relied upon to prevent the disease it may accomplish something in the nature of reducing the severity of the attack. In addition, it is not costly, so there is little to be lost and possibly something to be gained.

Treatment.

Treatment is a matter more of careful nursing than anything else in the average case. Some even hold that the best thing to do is to simply turn affected animals out to grass in an "isolation paddock" where there is good feed and shelter, and leave them to their own devices. This is, however, rather a radical view of the matter and not to be recommended in ordinary circumstances.

Of the first importance is that the patient's drinking water should be placed at a height of about 3 feet from the ground. The horse with pharyngitis will then drink much more easily and safely than will be the case if the drinking water is on the ground. Moreover, there will be much less water returned through the nostrils.

The food should consist largely of fresh greenstuffs (if such can be procured), or, failing this, prime lucerne hay freshly opened up and dampened. Boiled barley is excellent, as are occasional bran mashes if the patient will take them. Oatmeal gruel and linseed tea are other foodstuffs which can be tried in an endeavour to tempt the appetite of the "off his feed" horse.

The patient should be kept warm, especially at night, and be given light exercise at a walk daily.

Medical treatment is not essential, but possibly shortens the duration of an attack. Potassium chlorate —½ oz. dissolved in the drinking water twice daily—is useful; it acts as an expectorant and soothes the inflamed throat membrane. An electuary (medicine in semi-fluid form, placed on the tongue), made up as follows can be given (a tablespoonful) once or twice daily:—

Liquid extract of Belladonna	½ ounce
Camphor	1 ounce
Honey or treacle	8 ounces

This quantity is on the average sufficient for the treatment of one case of the disease.

A nasal inhalant ointment such as the well-known "Vicks" appears to be of considerable value in many cases. It is placed with the aid of the index finger in the false nostril, a cul-de-sac or "dead end" in the roof of the nostril considered as a whole. This is essential, otherwise the horse will simply snort and blow the ointment out again.

It is obvious that the nostrils and eyes should be cleaned of all discharge at frequent intervals. The cotton waste used by mechanics is excellent for this purpose and it can be burned immediately on account of its low cost.

Medicated steam inhalations are useful, but should not be overdone. One thoroughly efficient inhalation is probably all that is justified in the average case. Inhalations may be administered by one of two methods. In the first, a kerosene tin is placed inside a chaff bag and boiling water poured in until the tin is about one-third full. A teaspoonful of eucalyptus oil and/or Friar's Balsam is added and the mouth of the bag immediately drawn up around the horse's muzzle. If the amount of steam coming off is unsatisfactory remove the bag from the horse's muzzle and drop into the tin a horseshoe which has previously been heated to redness. In the other method a dish containing bran is substituted for the kerosene tin, the eucalyptus and/or Friar's Balsam mixed through the bran and finally boiling water added in sufficient quantity to reduce the bran to a moist pulp.

Surgical treatment is concerned with the abscess which forms under the jaw or elsewhere. When the swelling has been in evidence for a day or two it is usual to apply a blister or a mustard plaster after first clipping the hair on the site. In general this is a useful measure, but it is to be avoided over the upper reaches of the throat. The intention is to hasten development of the abscess and "bring it to a head." Very often it is doubtful whether any time is gained by applying a blister, but in odd cases the swelling regresses and disappears without the necessity for "opening," so that the procedure can be recommended as a routine measure. A suitable blister is a red (iodide of mercury) blister of a strength of one in eight, obtainable from any chemist.

There is considerable difference of opinion as to when the strangles abscess should be opened. Some prefer not to open at all, but to simply allow it to burst of its own accord, claiming that quicker healing then results with less tendency for secondary abscesses to occur. Others believe that the abscess should be opened as early as possible, holding that the sooner it is opened the sooner the patient will commence to improve. In general, and more especially in the absence of veterinary opinion, the abscess should be opened when it presents a definite "head," the indication of which is a patch of dead white skin over which the hair has fallen out or can be rubbed off without difficulty. Use a clean, extra sharp knife, the patient being restrained with a twitch during the operation. Make the incision towards the mouth (i.e., in the case of the abscess under the jaw) and parallel with the mid-line. Exercise control over the incision so that it will be only skin deep. If pus does not come away immediately, use a finger or a blunt instrument and penetrate into the abscess. Enlarge the opening (again with a blunt instrument or the fingers) so as to afford free drainage. Having evacuated the abscess, syringe out the cavity which remains with a reliable antiseptic solution and repeat this daily until healing is nearing completion.

Often an abscess develops in situations other than under the jaw. Some of these are in close association with large blood vessels and other vital structures and should only be opened by a competent veterinary surgeon.

The malignant or exceptionally severe type of strangles case may benefit from treatment by sulphonamide type drugs. Usually, however, there is no necessity to resort to this type of medication. It is expensive compared with ordinary medicines, has to be given in large doses and is only available on the prescription of a registered veterinary surgeon. In the case of valuable horses contracting the disease in a severe form, it is to be recommended.

GENERAL NOTES

Egg Production—Marketing Problem.

The Minister for Agriculture and Stock (Hon. T. L. Williams) stated recently that his attention had been drawn to a broadcast in which a poultry farmer had expressed the opinion that Great Britain would require all the eggs that we could produce next year. He further advocated that hatching should be commenced again in February in order to make up for the reduced hatching that has occurred during the present year owing to the shortage of fodder. Announcements of this nature can only be made by those who are not fully acquainted with the expansion that has taken place in poultry raising during the war period, or by those who have given little consideration to the problems of marketing. Such information can be most misleading and responsible for inducing persons to enter the poultry industry as a means of livelihood without weighing up all the facts and the soundness of such an undertaking.

Mr. Williams added that in the controlled area of this State, egg production had doubled. Expansion of this industry is not common to this State. In fact, throughout the Commonwealth it has increased from 55 to 115 million dozen, and a surplus of 65 million dozen is anticipated during the 1946-47 season. Great Britain was prepared to buy all the eggs that Australia could send her as eggs in shell this year, but had only agreed to purchase 30 million dozen from Australia during the coming year. This indicates that the industry will be faced with the problem of disposal of another 35 million dozen.

Dried egg powder is not now required. A limited market exists for egg pulp, but it is considered that in the very near future the price for pulp will be such that it cannot be produced for export under Australian costs of production. Therefore, any surplus must be shipped as eggs in shell.

Mr. Williams further stated that at a conference of the poultry industry held in Melbourne recently, a resolution was carried that the Department of Repatriation be advised of the problems confronting the poultry industry in order to guard against returned soldiers entering this industry without being fully acquainted with the hazards.

Quarantine Lifted in Mackay Sugar Area.

Because of the continued absence of downy mildew disease of sugar-cane in the Mackay district, action has been taken to cancel a proclamation issued under the *Sugar Experiment Stations Acts* in March, 1944, which declared the Farleigh, Racecourse, Pleystowe, Marian, Cattle Creek and North Eton mill areas to be a quarantine area because of the presence of this disease.

Stickfast Flea.

The Minister for Agriculture and Stock (Hon. T. L. Williams) referring recently to a further outbreak of stickfast flea which had been located in the Normanby Shire, said that inspectors had been working in that district with the object of ascertaining the extent of the infestation. The flea has been found on 26 properties which had all been quarantined. Unfortunately, the pest had been located almost on the borders of the Moreton Shire. It was believed that the pest had been introduced into most of these new areas by the movements of dogs, and farmers in the area were advised to exercise greater control over their dogs in an endeavour to avoid the introduction of the pest to their properties. Arrangements were being made for experiments to ascertain the efficacy of D.D.T. for the control of this pest. In order to check the spread of the flea, the co-operation of all farmers is necessary. The Minister added that an outbreak in the Helidon district in 1941 was eradicated by the destruction of all poultry on infested farms and the continued treatment of dogs, cats, and plant. It may again be necessary to adopt this method to prevent the spread of the flea into the more thickly populated poultry areas.

Rural Topics

The Mules Operation Checks Fly Strike.

Good reports on the results of the Mules operation under field conditions in Queensland continue to come in. Over a million sheep have already been successfully treated. Here is one example: In 1942, a flock of 2,000 odd ewes were operated on and when the sheep were mustered for sale this year, the loss from fly strike worked out at 4 per cent. per annum. These sheep went through a fairly bad period of fly attack, and also a drought, and, altogether, the result was considered satisfactory, especially in view of the average annual losses from various other causes among breeding ewes in that particular district.

Knowledge is Cheaper than Ignorance.

Pinch-penny economy in education is a curious method of making good the unfortunate wastage of war. Unnecessary or extravagant spending of money is not suggested, but when the inevitable reply to all requests for improvement in popular education has often been the stereotyped "question of finance" there is need to decide whether education is not of greater importance than some of the objects for which there is, apparently, never any shortage of cash. Any refusal or neglect to meet the just demands of education, and which ignores the effect of that refusal, or neglect, on the future well-being of the nation may bring disaster in the long run, for from a purely economic standpoint, apart from other obvious considerations, the most important part of the capital of a country consists of its citizens—just human beings. Expenditure on the moral, physical, and intellectual advancement of human beings is the best of all investments—an investment which pays the biggest dividends.

When differences in values are sized up some rather startling comparisons are found—what is spent on books and what is spent on beer, for example.

Education is the one thing for which no nation ever pays too much. Knowledge may cost a lot, but ignorance costs much more, especially as the greatest cause of waste. Ideas govern the world. "Where there is no vision the people perish." That is why proposals to extend agricultural education—to mention only one branch of enlightenment—and provide up-to-date libraries in country centres under trained management are warmly welcomed by country men and country women.

We All Live On Grass.

A generation or so ago there was a hard-boiled politician who in a moment of exasperation advised a hungry deputation to go and eat grass, without thought, probably, of the soundness of the free advice he handed out.

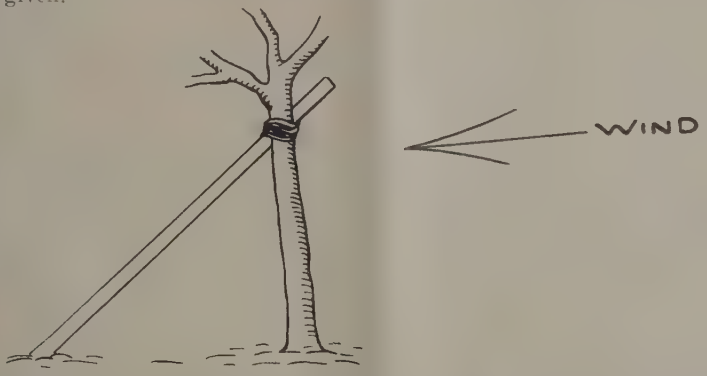
At one time farmers simply looked on grass as a cheap stock food provided by Nature for their especial benefit, and not as a crop which needed manuring or care of any kind. To-day, thanks to science, farmers are better informed and know that as with cultivable land, so with pasture, the best returns from a paddock of grass cannot be expected unless something is put back. Every beast which walks off a property to the saleyards carries with it some of the substances of the soil on which it was reared.

Grass is, after all, practically the basis of all life and it should be regarded as one of the most valuable foods for all kinds of livestock, not excepting the pig. Therefore, the first point in pasture management is to get a good crop of grass which will provide an early bite and keep on growing. Carefully planned systems of manuring and grazing will help in maintaining a good sward. With lack of good management, a paddock will soon be eaten out of all the best grasses and herbage. Nature can be helped a lot by keeping up the supply of natural food for stock. All flesh is grass, so obviously all of us live on grass, be it in the transmuted form of butter or a T-bone steak.

GADGETS AND WRINKLES

STAKING SMALL TREES.

In districts where the wind is fairly continuous from one quarter, the usual method of tying the trunk to a vertical stake driven in close to the roots can be improved upon. Unless the stake is unduly massive, it tends to be pulled over by the tree if placed vertically; whereas, if driven in at an angle, facing the prevailing wind, very strong support is given.



Additional advantages are that termites are not attracted to the base of the trunk, and there is less liability of damage to the roots; also there is more space between the trunk and the stake for weeding.

—W. G. HANCOCK.

MILKING MACHINE—KEEP THE AIRLINE CLEAN.

On modern milking plants the airline, like other mechanical parts, is simple to clean, but in some of the old-type machines it is very difficult to keep free from contamination. Milk of satisfactory quality can only be expected if the utmost care is given to cleaning the airline, as well as other parts of the plant.

Some careful producers flush out the airline daily, but investigations among suppliers to cheese factories have shown that milk of good quality can be produced with milking machines the airline of which is well flushed out and effectively steamed once weekly—twice weekly in the hotter months would probably be advisable.

FOR SAFETY'S SAKE.

Do not leave the garden or hay tools lying around wrong side up. Anyone who has been whacked in the face with the handle of a rake which had been left lying teeth up to be stepped on knows the reason why. So does anyone who has stuck a tine of a pitchfork into his ankle because the fork had been thrown on to the ground with the tines curving upward about ankle-high off the ground. When any garden or hay tool is left around it should be placed with the teeth or tines or cutting edge down.

Care of Mother and Child.

Under this heading an article supplied by the Maternal and Child Welfare Service of the Department of Health and Home Affairs, dealing with the welfare and care of mother and child, is published each month.

THE SPREAD AND PREVENTION OF INFECTION.

MANY mothers these days are making particular enquiries as to how to prevent their children from contracting the various sicknesses which are going about, and these notes are for the benefit of those mothers who cannot obtain advice personally.

In the first place, it should be understood that all infections are caused by living organisms. These organisms are of different shapes and sizes. Some can be seen by the aid of a microscope, some are too small to be seen even by this means.

Germ "Carriers."

These organisms, or germs as they are usually called, are carried about mainly by sufferers from a mild illness such as a common cold, and who therefore continue to go to school or work and mix with other people. There are others who are suffering from a mild attack of a more serious illness such as scarlet fever, which has not been recognised, and so they also continue to mix with other people. Then there are those who, while not suffering from a disease themselves, can still carry about the germs of some disease. For example, the child who is immune to diphtheria may carry the infection to a child who is not immune. Young children frequently put their fingers in their mouths, and may carry the infection from mouth or throat to their playmates through handling. For this reason, the child who has not been immunized is in greater danger.

Certain infections may be carried by people handling infective material. For instance, when caring for a child with diarrhoea, carelessness or lack of cleanliness in dealing with napkins may cause the infection to be conveyed to food.

Flies and other insect pests can carry disease germs. Flies are very troublesome in the early summer and they alight on infected matter, and carry germs on their legs. These are then conveyed into milk, water, or other food which has been left uncovered.

Once mothers thoroughly understand *how* diseases are spread, it is not so difficult to understand the basic principles of protecting their children from infection.

Prevention.

The most important thing is to build up the children's general resistance, so that although they may come into contact with infection they will not easily become ill. Food of the right kind is particularly necessary, and all children should have

one pint at least every day of pasteurized or scalded cow's or goat's milk, or dried milk if fresh milk is unobtainable or the supply unreliable. Fresh fruit and green leafy as well as root vegetables, and porridge made of whole grains such as wheat meal, cerevite or oatmeal, and, of course, whole meal (not just brown) bread and the full weekly ration of butter.

Children should be kept in the fresh air and sunshine as much as possible and away from crowded buildings where there may be many people who are carrying disease germs. Do not allow even the family to kiss babies and young children on their mouths. Let each child have his own cup or mug and his own washer and towel.

Boil all milk which is not pasteurized and sold in sealed bottles. Keep all food clean, cool and very carefully covered from flies and dust. Wash your hands before handling food. Keep all rubbish tins covered and scrub them frequently with hot soapy water. Get rid of flies by preventing them from breeding and by spraying or any other means recommended by the local town or shire council. Hands should be washed after changing the baby and the napkins put immediately into a bucket of water or disinfectant. Teach children clean habits.

Any further information may be obtained by communicating personally with the *Maternal and Child Welfare Information Bureau*, 184 *St. Paul's Terrace, Brisbane*, or by addressing letters *"Baby Clinic, Brisbane."* These letters need not be stamped.

IN THE FARM KITCHEN.

Cakes for Smoko.

Ginger Biscuits.

Required: 4 oz. flour (or sifted meal), 1 teaspoon of ground ginger, ¼ of a teaspoon of baking soda, 1½ oz. butter, 1 tablespoon of golden syrup and 1 dessertspoon of sugar. Place the syrup, butter and sugar in a pot to dissolve, keeping them stirred. Allow to cool. Add the flour, soda and ginger. Roll small portions into ball and press down with fork. Bake in a moderate oven for ten minutes.

Cream Sugar Cookies.

Very plain little biscuits these, but very popular. Pour 1 cup of cream into your mixing bowl. Stir in 1 two-thirds cups of sugar, 1 well-beaten egg, ½ a teaspoon of salt and ¾ of a teaspoon of nutmeg. Sift 3 teaspoons of baking powder with 4 cups of flour and beat into the first mixture. Add enough flour to make the dough easy to handle (about 1 to 1½ cups). Roll out to one-third in. thickness and cut into biscuits. Dust thickly with sugar and bake in a moderately hot oven about ten minutes.

Cheese Cake Mixture.

Required: Sugar, 2 oz.; egg, 1; butter, 1½ oz.; lemon, 1; cornflour, ½ oz.; water, 1 gill. Grate the lemon rind on to the sugar. Mix the cornflour thinly and smoothly with a little of the cold water. Put the rest of the water and the strained lemon juice on to boil. Add the butter and sugar. When boiling, stir in the mixed cornflour. Reboil till all raw taste has gone, stirring all the time. Take the pan off the fire and cool down its contents a little. Beat the egg, gradually stir it into the cornflour. Mix well, and reheat without again boiling, beating it briskly all the time. Orange instead of lemon can be used. Very good with the egg left out. Keeps good for a week or more in cool, dry place.

Cockles.

Three eggs, their weight in butter, sugar, flour and cornflour. Beat butter and sugar, add eggs, then flour. Put dessertspoonfuls on slide and bake.

Biscuits for Cheese.

Required: 4 oz. flour, ½ a teaspoon of baking powder, ½ a teaspoon of salt and ½ a gill of milk. Sift the flour, baking powder and salt, add the milk and mix with a fork into a smooth dough. Flour a board, roll very thin and cut into shapes. Prick and bake in a fairly hot oven until golden brown in colour. These can also be made with meal.

ASTRONOMICAL DATA FOR QUEENSLAND.

DECEMBER 1945.

Supplied by the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Date.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	4.45	6.28	Cairns	51	6	Longreach	44	26
6	4.46	6.32	Charleville	30	24	Quilpie	33	37
11	4.47	6.35	Cloncurry	65	35	Rockhampton ..	19	1
16	4.49	6.38	Cunnamulla ..	27	32	Roma	19	15
21	4.51	6.41	Dirranbandi ..	16	22	Townsville	42	8
26	4.54	6.43	Emerald	28	11	Winton	52	29
31	4.56	6.46	Hughenden ..	49	21	Warwick	2	6

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Date.	Rise.	Set.
	a.m.	p.m.
1	2.38	3.24
2	3.08	4.15
3	3.41	5.08
4	4.17	6.02
5	4.56	6.57
6	5.39	7.51
7	6.28	8.43
8	7.20	9.33
9	8.17	10.19
10	9.15	11.02
11	10.15	11.42
12	11.15	..
	p.m.	a.m.
13	12.16	12.19
14	1.18	12.56
15	2.23	1.33
16	3.29	2.12
17	4.37	2.55
18	5.47	3.42
19	6.55	4.35
20	7.58	5.34
21	8.54	6.36
22	9.44	7.40
23	10.26	8.42
24	11.03	9.42
25	11.37	10.39
26	..	11.33
	a.m.	p.m.
27	12.09	12.25
28	12.39	1.17
29	1.09	2.09
30	1.41	3.01
31	2.16	3.55

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27 ; Cunnamulla 29 ; Dirranbandi 19 ;
Quilpie 35 ; Roma 17 Warwick 4 .

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Date.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	21	16	37	32	12	8	43	36
6	28	11	44	25	19	0	52	28
11	25	14	42	30	16	5	48	34
16	14	23	30	39	5	14	34	44
21	11	29	26	44	1	19	29	52
26	19	20	34	37	10	11	39	42
31	25	13	42	28	16	3	48	31

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Date.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	33	22	53	45	38	30	28	20
3	42	13	58	40	43	25	35	14
5	48	7	63	36	48	21	40	8
7	52	5	66	34	50	20	43	7
9	50	8	64	36	48	22	41	9
11	44	16	60	42	45	27	36	16
13	33	21	53	45	38	30	28	19
15	22	33	46	53	30	38	20	28
17	12	42	39	59	24	44	12	36
19	7	49	36	63	21	49	8	41
21	7	51	36	64	21	50	8	43
23	13	45	40	60	25	46	14	37
25	22	37	46	56	30	41	20	32
27	31	29	52	50	36	35	26	25
29	36	19	55	44	40	29	30	18
31	44	11	60	38	45	24	36	12

PHASES OF THE MOON.

New Moon, December 5th, 4.06 a.m.; First Quarter, December 12th, 9.05 p.m.; Full Moon, December 19th, 12.17 p.m.; Last Quarter, December 26th, 6.00 p.m.

On December 22nd at 3 p.m. Eastern Australian Standard Time, the Sun reaches its maximum declination south and will rise and set, viewed from Southern Queensland, about 26 degrees south of true east and true west respectively. Viewed from Northern Queensland it will rise and set, respectively, about 24 degrees south of true east and true west. For several days before and after this date there will be no appreciable change in the direction of the Sun's rising and setting and though theoretically this will be the "longest day" in the Southern Hemisphere, the difference in the length of days for a few days each side of the 22nd, cannot be noticed.

On December 14th and 26th the Moon will rise and set very close to true east and true west respectively.

Venus.—At the beginning of this month Venus may be seen low in the east during morning twilight, rising between 4 a.m. and 5 a.m. At the end of the month, however, it is too close in line with the Sun for observation.

Mars.—This planet at the beginning of the month will rise between 10.15 p.m. and 10.45 p.m. about 23 degrees north of true east. Towards the end of the month it will be visible low in the west during morning twilight, rising between 8 p.m. and 9 p.m., 25 degrees north of true east and setting an hour or two after sunrise.

Jupiter.—Jupiter at the beginning of this month, in the constellation of Virgo will rise between 2 a.m. and 3 a.m., about 8 degrees south of true east. At the end of the month it will rise soon after midnight, about 10 degrees south of true east.

Saturn.—At the beginning of the month, Saturn will rise between 9.30 p.m. and 10.30 p.m., about 23 degrees north of true east. At the end of the month it will rise between 7.30 p.m. and 8.30 p.m. It will thus be visible low in the western sky during morning twilight, setting not long after sunrise.

TOTAL ECLIPSE OF THE MOON.

On the night of December 18th-19th, from 1.40 a.m. to 3.00 a.m. Greenwich Mean Time, the shadow of the Earth will completely cover the face of the Moon. This eclipse of the Moon, however, will not be visible from Australia, for then (11.40 a.m. to 1 p.m. Eastern Australian Standard Time) our part of the globe will be turned towards the Sun, and when the Moon rises here—between 6.45 p.m. and 7.45 p.m.—it will have completely passed out of the Earth's shadow. It has been mentioned in previous discussion that an Eclipse of the Moon occurs at Full Moon, when the Earth is between the Sun and the Moon and when the centres of the three bodies are in line. The Moon is then visible to that part of the Earth turned away from the Sun and at the same instant the same phase of the Eclipse is witnessed by all observers in that Hemisphere.

QUEENSLAND WEATHER IN OCTOBER.

Most of the Central lowlands and highlands, Central coast (east and west), and Port Curtis subdivisions received over average aggregate rainfalls of a little over 2½ inches. The rains, variable thunderstorms with local hail, occurred mainly between the 17th and 21st. There were also restricted over-average rain areas in the Herbert, South Peninsula, East Carpentaria, and Far South-west districts, but in most other inland pastoral areas of the State October was the third dry and under-average rainfall month in succession. General thunderstorms would be welcome especially in the Carpentaria, Western and Southern Interior districts where the previous poor and erratic rain season had given little or no pasture holding capacity. Most of the south-east quarter general farming, dairying, and pastoral sections had had fair to good rains, but the Maranoa and Downs needed further falls to offset the dry spell of September and October. Some wheat areas were affected at a critical stage by the frosts of September and early October, and there was also local hail damage. General growth throughout the season, however, had been good, and given good harvesting weather well over average yields is expected.

Temperatures.—Cool month generally with both maximum and minimum average figures below normal, the former from 0.8 degrees at Georgetown to 4.9 degrees Thargomindah and 5.1 degrees Boulia, the latter approximately 1 to 2 degrees at most stations.

Frosts.—(Mainly Down Highlands) 1st to 5th (light Stanthorpe 6th/8th), 12th/13th and 30th. Stanthorpe 11 nights 29/21 degrees (3rd), Mitchell 2 nights 36/32 degrees (3rd).

Hail.—Lyndhurst Station (East Carpentaria) 19th, 120 points in 10 minutes. Hail as big as hens' eggs. Trees stripped. Birds killed.

Brisbane.—Mean pressure $\frac{9 \times 3}{2}$ 30.021 inches (normal 30/057 inches). *Temperatures,* mean maximum 77.7 degrees (normal 79.4 degrees); mean minimum 59.0 degrees (normal 60.1 degrees); mean temperature 68.3 degrees (normal 69.8 degrees). Highest daily, 87.7 degrees (10th), lowest daily 47.4 degrees (3rd). *Rainfall,* 273 points on 8 days (normal 259 points on 9 days).

The rain position is summarised below—

Division.	Normal Mean.	Mean Oct., 1945.	Departure from Normal.
	Points.	Points.	Per cent.
Peninsula North	45	23	49 below
Peninsula South	70	76	9 above
Lower Carpentaria	52	10	81 below
Upper Carpentaria	76	34	55 ,,
North Coast, Barron	133	77	42 ,,
North Coast, Herbert	178	222	25 above
Central Coast, East	129	290	125 ,,
Central Coast, West	77	283	268 ,,
Central Highlands	146	283	94 ,,
Central Lowlands	98	220	124 ,,
Upper Western	60	9	85 below
Lower Western	71	49	31 ,,
South Coast, Port Curtis	208	263	26 above
South Coast, Moreton	274	215	22 below
Darling Downs East	223	85	62 ,,
Darling Downs West	165	87	47 ,,
Maranoa	161	62	61 ,,
Warrego	110	103	6 ,,
Far South-West	86	80	7 ,,

Commonwealth of Australia Meteorological Bureau, Brisbane.

1st November, 1945.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

SEPTEMBER RAINFALL.

(Compiled from Telegraphic Reports).

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Sept.	No. of years' records.	Sept., 1944.	Sept., 1945.		Sept.	No. of years' records.	Sept., 1944.	Sept., 1945.
North Coast.	In.		In.	In.	*South Coast—contd.*	In.		In.	In.
Atherton	0·74	42	2·30	0·45	Gatton College ..	1·43	44	1·36	Nil
Cairns	1·65	61	4·48	0·19	Gayndah	1·47	72	0·56	3·08
Cardwell	1·47	71	1·18	0·61	Gympie	2·02	73	1·78	1·67
Cooktown	0·56	67	1·90	Nil	Kilkivan	1·61	62	1·11	1·31
Herberton	0·55	57	1·15	0·49	Maryborough ..	1·84	72	1·24	3·14
Ingham	1·51	51	2·56	0·66	Nambour	2·26	47	2·86	2·84
Innisfail	3·52	62	5·89	2·15	Nanango	1·71	61	0·74	1·81
Mossman	1·93	19	3·42	0·46	Rockhampton ..	1·22	72	0·74	2·84
Townsville	0·70	72	0·05	0·09	Woodford	2·04	55	1·45	2·05
Central Coast.					*Darling Downs.*				
Ayr	1·21	56	Nil	0·21	Dalby	1·61	73	1·70	0·97
Bowen	0·77	72	0·09	0·94	Emu Vale	1·66	47	2·26	0·92
Charters Towers ..	0·75	61	Nil	0·22	Jimbour	1·52	64	1·47	1·72
Mackay	1·60	72	0·75	1·31	Miles	1·26	58	1·62	1·39
Proserpine	1·89	40	2.30	1·17	Stanthorpe	2·19	70	1·12	1·78
St. Lawrence ..	1·19	72	1·08	3·57	Toowoomba	2·01	71	1·75	1.34
South Coast.					Warwick	1·75	78	1·50	0·93
Biggenden	1·38	44	1·00	3·15	*Maranoa.*				
Bundaberg	1·48	60	0·81	3·26	Roma	1·32	69	1·80	0·07
Brisbane Bureau ..	1·95	93	1·49	3·17	St. George	1·03	62	0·76	0·35
Caboolture	1·76	67	1·91	2·23	*Central Highlands.*				
Childers	1·64	48	1·58	2·58	Clermont	0·95	72	0·07	0·27
Crohamhurst	2·49	50	2·92	1·43	Springsure	1·22	74	0·60	0·44
Esk	1·94	56	1·29	3·66					

CLIMATOLOGICAL TABLE FOR SEPTEMBER.

(Compiled from Telegraphic Reports.)

Divisions and Stations.	Atmospheric Pressure Mean at 9 a.m.	Shade Temperature.		Extremes of Shade Temperature.				Rainfall.	
		Mean Max.	Mean Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Pts.	
Cairns	..	83	60	93	26, 27	60	5	19	3
Herberton	..	77	54	90	24	43	26	49	5
Townsville	..	82	64	95	25	53	2	9	1
Brisbane	30·13	74	53	81	21	46	6	317	7
Darling Downs.									
Dalby	..	74	45	84	30	31	6	84	3
Stanthorpe	..	67	39	79	30	26	6	178	5
Toowoomba	..	69	45	81	30	31	6	134	3
Mid-Interior.									
Georgetown	30·00	91	58	98	23	46	26	Nil	..
Longreach	30·03	87	55	98	20	42	1	Nil	..
Mitchell	30·10	77	44	92	23	33	2, 6	5	1
Western.									
Burketown	..	90	62	99	24	53	1	Nil	..
Boulia	30·05	88	56	99	19, 29	40	2	Nil	..
Thargomindah	30·05	79	52	95	29	40	5	Nil	..

A. S. RICHARDS, Divisional Meteorologist.

Commonwealth of Australia,

Meteorological Bureau, Brisbane.